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ABSTRACT

A design-oriented, interactive computer system which makes possible the dynamic loading of programs at the user's request throughout the operating session has been developed. This system, which is referred to as DEX, also allows the user to select various types of files as the source and destination of information during the session. With respect to one type of file, databases, DEX introduces a more versatile form of organization and use.

An extended DEX library of subroutines is developed which enables the user to read and write integer scalar, real scalar and one-dimensional real array variables and to edit from the terminal integer and real scalar values. It also enables the user to employ during input and output sequences the unit system of his choice.

A proposal is offered for the organization of DEX databases for the preliminary design of naval ships. Suggestions are made, based on a demonstration computer program, for employing existing ship databases to support a generalized ship synthesis model.

ABSTRACT

A menu-oriented, interactive computer system which makes possible the dynamic loading of programs at the user's request throughout the interactive session has been developed. This system, which is referred to as DSS, also allows the user to select various types of files as the source and destination of information during the session. With respect to one type of file, databases, DSS introduces a more versatile form of organization and use.

An extended DSS library of subroutines is developed which enables the user to read and write integer scalar, real scalar and two-dimensional real array variables and to omit from the external integer and real scalar values. It also enables the user to assign during input and output sequences the unit system of his choice.

A proposal is offered for the organization of DSS databases for the preliminary design of naval ships. Suggestions are made, based on a demonstration computer program, for reducing existing time [illegible] to develop a generalized ship synthesis model.

AN INVESTIGATION INTO THE USE OF DATA BASES IN COMPUTER-AIDED NAVAL SHIP DESIGN

by

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Lieutenant, United States Navy
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(1973)

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AN INVESTIGATION INTO THE USE OF DATA BASES IN COMPUTER-AIDED NAVAL SHIP DESIGN

by

RICHARD CHARLES CELOTTO

Submitted to the Department of Ocean Engineering
on May 8,1981 in partial fulfillment of
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and
Ocean Engineer

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CHAPTER 1

INTRODUCTION TO DEX

1.1 Background

Significant improvements in the capability and efficiency of computer-aided design systems have been achieved in the past decade by the introduction of interactive computer programs. This development was a major advance in providing more flexibility to the user at the input end of the process. However, too many of the innumerable design programs, and the design systems that incorporate collections of them, suffer from several bothersome problems:

(i) Less, but still excessive, restrictions on the flexibility of the programs to respond to the individual user's needs.

(ii) Incompatibility of input and output amongst programs and especially between programs and databases.

(iii) Excessive training time required for users to learn how to use the programs.

(iv) Inability to be transported to different facilities.

In 1974, researchers at the Massachusetts Institute of Technology and the University of Michigan felt that an investment in the "front end" of computer-aided design systems could eliminate or reduce these characterstics

and result in design tools of greatly enhanced capability [1], [2], [3]. One of their goals was to develop a system that provides the designer almost as much flexibility at the computer terminal as he/she* has when sitting at a desk with pencil, paper, calculator and imagination at their disposal. The system would be easy to use because of a consistent approach to the interface between the user and the programs. Further, it would incorporate a more intelligent approach to the use of databases. They named this concept "DEX", for Design Executive System.

DEX is a self-contained software package that can be adapted to almost any computer system that supports Fortran. It provides an environment for running task-oriented programs, called "modules". It supports primarily, but not exclusively, interactive programs where there is communication between essentially five "parties": the user, the computer, the computation program, the source of input and the destination of output.

The purpose of the work reported in this thesis was to continue the development of the system at the intermediate level in the DEX hierarchy between what is referred to as "(the) DEX" and the "module". This intermediate

---

*The use throughout this thesis of the proper pronoun "he" and its derivatives when referring to the programmer, user or designer is for the smoothness of the text and is not to imply any presumption of those persons's sex.

category of subprograms is called the "extended DEX library". (The collection of all the design program modules is called the "DEX library".) The function of the extended DEX library is to enable the user to accomplish the following:

(i) Establish an environment in which the type of dialogue and the source and destination of information is defined.

(ii) Specify the system of units to be used for input and output.

(iii) Read information.

(iv) Edit information.

(v) Write information.

This investigator's motivation was to advance the development of an extremely capable tool for the field of ship design, but it should be stressed that DEX can be employed by any discipline involving computer-aided design.

1.2 Description of DEX

1.2.1 Theory. Reference [3] provides an original and excellent description of DEX, but this writer felt that some discussion should be presented here to assist the reader in relating to the information offered in this thesis.

There are five characteristics of DEX which reflect the design philosophy of the system:

(i) The user is in the design loop.

(ii) The system allows the design process to be executed in more than one sequence.

(iii) The system talks with the user in plain English.

(iv) The system is forgiving.

(v) The system has multiple capabilities for input and output.

1.2.1.1 The user in the design loop. Design processess are typically iterative ones. This is especially true in the ship design process as vividly illustrated by the ship design spiral. Computer programs allow many and/or complicated calculations to be performed quickly. The faster that the results can be analyzed and a new set of calculations initiated, the better. Even more advantageous is the ability to do only part of the calculations and analyze those results to decide whether or not to proceed. DEX extends the degree of spontaneity characteristic of interactive programs by enabling the dynamic starting of modules of the user's choice, by providing more options for sources of information immediately available to the user and by allowing the user to edit and insert information before it is used in calculations or written to its final destination.

1.2.1.2 Flexibility. The increased flexibility offered by DEX manifests itself in two ways. The first, implemented to allow any computer program acceptable to the operating system to be operated in a system incorporating DEX, is that the degree of involvement with DEX is completely within the prerogative of the module author. The term "module author" was introduced in reference [3] and will be adopted here for consistency. It applies to the person who writes the particular application program and who chooses which DEX services to use. As a minimum, the module author can arrange for the user to issue only the following commands to execute the program:*

. start main (this activates DEX)

. begin module2 (this starts the user's program)

There would not really be any point to such an exercise but it can be done by fulfilling only two requirements. First, the name of the file containing the module name (e.g., module2 above) must be introduced in the DEX's

---

The symbol "." will be used to indicate user-typed commands, "$" will indicate DEX messages and "" will indicate module messages. These symbols are automatically inserted by DEX.

library file. Secondly, the main program of the module must be a subroutine appearing first in a listing of the module.

The second aspect of the DEX's flexibility is the use of "menus" to provide the user with a wide choice of paths to follow to accomplish his goal. A menu is a list of options (a maximum of twelve per menu is possible) from which the user chooses to either define a value or proceed onto the next step of the operation. Some examples should prove helpful.

Figure 1-1 depicts a typical units menu which illustrates the first type of menu. The user would type in sufficient characters to identify the length unit to be used for input or output, e.g., "foot" (or just "f"). The subprogram which includes this menu would accept the choice, if proper, and return control to the subprogram which called it.

Menus are normally not displayed. The user will likely be aware of the menu options and is simply prompted to make a choice. For this example, one would see:

    *ENTER AN ITEM FROM MENU - LEN.UNIT

However, if the menu choices are unknown, the user can type

```
$     + -------- +
$     +   MENU   +
$     + LEN.UNIT +
$     + -------- +
$   1 + INCH     +
$     + -------- +
$   2 + FOOT     +
$     + -------- +
$   3 + STATMILE +
$     + -------- +
$   4 + NAUTMILE +
$     + -------- +
$   5 + MILLIMET +
$     + -------- +
$   6 + CENTIMET +
$     + -------- +
$   7 + METER    +
$     + -------- +
$   8 + KILOMET  +
$     + -------- +
```

Figure 1-1. Menu "LEN.UNIT"

```
$     + -------- + -------- +
$     +   MENU   +   MENU   +
$     + MOD.IO   + INPUT    +
$     + -------- + -------- +
$   1 + INPUT    + ALL      +
$     + -------- + -------- +
$   2 + OUTPUT   + UNITS    +
$     + -------- + -------- +
$   3 + DONE     + CA       +
$     + -------- + -------- +
$   4 +          + WATER    +
$     + -------- + -------- +
$   5 +          + HULLFORM +
$     + -------- + -------- +
$   6 +          + SPEEDS   +
$     + -------- + -------- +
$   7 +          + DONE     +
$     + -------- + -------- +
```

Figure 1-2. Two Consecutive Operational Menus

```
.$display menu len.unit
```

to have the menu displayed by the DEX. Note that in this case the user himself types "$". The word "display" is a selection from menu "DEX.MAIN". After reviewing the menu, by typing

```
.continue
```

he is returned to the prompting message for the length unit menu.

The second type of menu option directs the program to proced to the next operation. Figure 1-2 shows two successive "operational" menus from a theoretical program that estimates horsepower from the Taylor Standard Series. The user would select item "input" from menu "MOD.IO" in order to pass onto the subprogram containing the menu "INPUT". Any of the items from that menu would pass him onto another subprogram.

There is a subtle difference between the menus of Figure 1-1 and 1-2. Observe that the second shows the item "done" in both menus which is absent from the first. A subprogram with a menu containing "done" returns control to the subprogram which called it only when that entry is selected, whereas for the other, without a

"done", control returns automatically once a selection is made. The latter is used in menus where only one choice would be made at any time.

The user is free to choose any item from a menu that is meaningful to him. There is, therefore, no one predetermined path that must be followed when executing a group of menus. Logic, however, may dictate that one specifies units before reading in water properties.

1.2.1.3 Plain English. The messages and queries to the user provided by DEX have been designed to be as clear as possible. The instructions or responses that the user must supply are natural and logical words that would be used in an oral dialogue. An important aspect of these practices is the uniformity of dialogue encountered by the user under DEX. This reduces the effort required to learn how to operate a new program, which is not an insignificant advantage.

1.2.1.4 Forgiving. By extending the capabilities of the conventional design programs with DEX, the user can accomplish more during a session, but this entails more thinking on his part. The probability that errors will occur is therefore higher.

Even the most experienced user makes mistakes. It may be as simple as depressing the wrong key when typing a menu selection or as improper as supplying an integer

when the program wants a real number. When developing the DEX and extended DEX library routines, and the Machinery Weight Estimating Module of Chapter 8, as many potential errors as possible were anticipated and diagnostic messages, in plain English, were provided. In some cases they advise the user of the error and allow him to try again at that same point. In others, especially where a problem is caused by a programming error, control is returned to the user several sequential subroutines prior to where the error occured, with a message issued to assist in determining where to search for the mistake.

1.2.1.5 Input/Output Capability. DEX enables the communication of information by the dynamic allocation of databases and files, which are the only two storage locations it recognizes. In practice we distinguish between two types of files, such that the list of locations is as follows:

(i) databases

(ii) input locations (which are the terminal for alphanumeric characters and a graphics screen for x-y coordinates) and output locations (the terminal screen in the form of menus)

(iii) disk files.

Now, for the ease of understanding of the user, the environment in which he operates is described as

having a total of five "sources" of information and four "destinations". The term "information" is preferred here to "input" and "output" to preclude a limiting misconception by the reader. The tendency to think of input as data read and output as answers written should be avoided. In fact, the user may need to "write" input to the terminal for inspection, or "read" an output value from the terminal in order to "write" it to a database. For this reason this writer will often apply the term "information" to both input and output variables as values that have a source or destination.

The sources and destinations provided for in the operating environment of the DEX system described in this thesis are listed here:

(i) DEX-created databases

(ii) the terminal using DEX routines to read or write alphanumeric characters

(iii) the terminal or a plotter using graphics routines to read or create x-y plots

(iv) sequential files

(v) module default data (source only)

The third capability does not yet exist in the present version of DEX at MIT because all the necessary enabling routines have not yet been implemented. If the user tries to employ it, error messages advise him of this situation.

The user is not confined to using the same type of destination as source, or the same source for all the information of a program. He may read information from one or more databases, for example, and write it to another, or to the terminal or to a file, or all three in succession. The only restriction is that the module can be pointed toward only one source or destination at one time.

1.2.2 Organization. The hierarchy of DEX consists of three levels of programs: the DEX, the extended DEX library and the module. The first two categories comprise a permanent, portable set of subprograms which provides an interface between the computer and the user-supplied module.

1.2.2.1 DEX. The category called DEX consists of several hundred subroutines, each with a very specific function, which provide the foundation, or "umbrella" if you will, for the DEX System. The employment of these subroutines by the module authors results in a uniform appearance of the system to the user of the various modules exercised. The DEX services provide input/output and data utilities and, eventually at MIT, graphics utilities for the module authors. Although the module author and user need not be aware of most of these subprograms, in two areas they draw directly on the features of routines in this category.

The first area, of interest to the module author, is a set of 37 subroutines and functions which the programmer may incorporate into his module to perform certain tasks. References [4] and [5] describe these subprograms and how they are used. Briefly, they are grouped into five categories: control of execution, input, output, database management and character manipulation. Subsequent chapters will refer to these as "DEX routines".

The second area of overt involvement with the DEX category is encountered by the user during operation of a module. When the command

```
.start main
```

is issued, the user enters the DEX environment and is presented with a prompting message for menu "DEX.MAIN". There are six menus at this level of DEX, and these are listed in Figure 1-3. The first instruction given to the user is:

```
$ENTER AN ITEM FROM MENU - DEX.MAIN
```

These items are listed in the rightmost column in the table. Note menu "DEX.DISP" which allows the user to display any menu by typing

```
.display menu menuname
```

	MENU DB-TYPES	MENU DBEDCMDS	MENU DXYES-NO	MENU DEX.ALTR	MENU DEX.DISP	MENU DEX.MAIN
1	INTEGER	CREATE	YES	TERSE	MENU	LIBRARY
2	REAL	STORE	NO	VERBOSE	NEWS	HELP
3	ARRAY-RL	DELETE		KEYBOARD	MODE	DISPLAY
4		COMMENT		GRAPHIC		ALTER
5		EXPLAIN		ECHO-ON		TIDY
6		PRINT		ECHO-OFF		OPEN-DB
7		DUMP		DONE		EDIT-DB
8		SET-TITL				CLOSE-DB
9		GET-TITL				BEGIN
10		DONE				CONTINUE
11						SYSTEM
12						QUIT-DEX

Figure 1-3. DEX Menus (as printed on terminal)

The user's module is activated when he types, from menu "DEX.MAIN",

.begin modulename

He then enters the environment of the module, but he can return to the DEX level by using the symbol "$" and then an item from "DEX.MAIN". Similarly, he can transfer temporarily from the DEX level to the local computer operating system level by the option "system". To get back into DEX he uses the command

.return

and then to get back to the module he uses the menu option "continue".

When a module execution is complete, the user returns to the DEX level and issues the command

.quit

to return permanently to the operating system.

1.2.2.2 <u>Extended DEX Library</u>. The extended DEX library is not a level of operation like DEX on the module, but rather a collection of 45 subroutines and functions which the module author can adopt in constructing his module. The bulk of this investigator's work involved the development of this library, and it will be discussed further in Section 1.3 and Chapters 3-7.

1.2.2.3 Module. A module is a complete set of subprograms written by the module author and executed by the user to perform a specific task. A module may consist of only one program which does the actual calculations, or it may have many additional subprograms employing menus to take advantage of the flexibility offered by DEX and the extended DEX library. Chapter 2 describes in detail an actual module used during the testing of the extended DEX library subprograms, and Chapter 8 describes the Machinery Weight Estimating Module written to demonstrate the use of the cruiser-destroyer databases.

1.3 The Extended DEX Library

In order to convey information from a storage location to the program doing the calculations and from there to another storage location or display, five capabilities are required by the user. These five, listed here, are provided by the extended DEX library:

(i) Setting and reviewing the module environment for type of dialogue and sources and destinations of information.

(ii) Reading information.

(iii) Editing information.

(iv) Writing information.

(v) Converting the user-preferred input/output units to the module author-preferred units and back again.

The five categories will be briefly outlined here and described in detail in Chapters 3-7.

1.3.1 Environment. Four subroutines provide or display the module environment defined by the user. They are:

DIALOG: enables user to specify terse or verbose dialogue

SOURCE: enables user to specify source of information, either a DEX-created database, the terminal, a sequential file or the module's default data.

DESTIN: enables user to specify the destination of information, either a DEX-created database, the terminal or a sequential file

MDMODE: displays the status of the module environment, including type of dialogue, reading source, writing destination, and reference numbers for files to be read from or written to.

1.3.2 Readers. Eight logical functions allow the user to read information from the designated source. They are:

ISCLDR: invokes ISCPMP and ISREAD

ISCPMP: prepares a prompting message for reading an integer from the terminal

ISREAD: reads an integer value from the source.

RSCLDR: invokes RVAPMP and RSREAD

RVAPMP: prepares a prompting message for reading a real scalar or a real array from the terminal.

RSREAD: reads a real scalar value from the source

RA1LDR: invokes RVAPMP and RA1RED

RA1RED: reads a single one-dimensional array from the source.

1.3.3 Editors. The editing routines are still undergoing development. Eventually they will enable the user to perform various editing functions on the working variables of the module. Two preliminary routines were completed during this investigation:

ISCEDT: enables the user to change the value of an integer scalar variable from the terminal.

RSCEDT: enables the user to change the value of a real scalar variable from the terminal.

1.3.4 Writers. Eight logical functions allow the user to write information to the designated destination They are:

ISCDMP: calls ISDSCR and ISRITE

ISDSCR: prepares a description message for writing an integer to the terminal

ISRITE: writes an integer scaler to the destination

RSCDMP: calls RVDSCR and RSRITE

RVDSCR: prepares a description message for writing a real scalar or a one-dimensional real array to the terminal

RARDMP: calls RVDSCR and RARITE

RARITE: writes one-dimensional real arrays to the destination

1.3.5 Units. The units subprograms are divided into three categories. The first category contains five subroutines which read, edit or write the input/output units that the user wishes to employ. There is one for each of the five basic types of units adopted by the system: plane angle, force, length, temperature and time. The names of these subroutines are:

AUNIT

FUNIT

LUNIT

TPUNIT

TUNIT

The second category contains five logical functions, one for each of the five basic unit types, which determine the conversion factors for converting to i/o units to the program standard units and vice versa. Additionally, they prepare unit names and abbreviations of unit names which are used in database comments and prompting and description messages. The names of these functions are:

UNITAF

UNITFF

UNITLF

UNITMP

UNITTF

The last category contains twelve logical functions which perform the same function as those in the second category, but for derived units formed by combining basic units. They are:

UAACC: angular acceleration

UACCEL: linear acceleration

UAREA: area

UFREQ: frequency

UKVISC: kinematic viscosity

UMASS: mass

UMPOWER: mechanical power

UPRESS: pressure

UPSPEC: power spectrum

URHO: density

USPEED: speed

UVOL: volume

1.4 Dex Databases

1.4.1 Philosophy. The DEX philosophy includes as a fundamental feature a new and more capable approach to database manipulation. This revolves around the concept of identifying a variable within a database by its name and not by its location. For example, if a user needs the value of an entry in the database signifying the ship's draft, he retrieves that value at the address "DRAFT', or whatever name it has been assigned by the database creator, and not by specifying that the value is the fourth or twentieth entry in the database.

In order to use the capabilities of DEX a database must be constructed via either the commands of menu "DBEDCMDS" or the database management routines in reference [4]. These entail a specific format for the entry of the variable, but there is no sequential order required for arranging the different variables in the database.

1.4.2 Format of Database Entries. In the present version of DEX a database can contain up to 200 variables. Three types of variables are allowed: integer scalars, real scalar, and one-dimensional real arrays. A real array can contain up to 200 elements.

A variable entry in a database consists of four parts. First is the database name, which is formed by

up to eight alphanumeric characters (including blanks), e.g., "LBP", "WEIGHT17", "TYPSONAR". Second is the type of variable - integer, real scalar or real array - and third is the value of the variable itself. The final part is the database comment statement, a string of words up to 64 characters long which describes the variable. If the variable is either a real scalar or real array and has units, the comment statement contains a twelve-character (including blanks) version of the units enclosed in parentheses. Appendix B contains edited listings of a warship general database which illustrates database entries.

Accompanying each database will be a database dictionary which lists for each variable its database name, type, array size, if applicable, and official database comment, including units, if applicable. Future versions of DEX will separate the units from the comment as a distinct fifth part of a variable entry. Further, development has started to create positional databases which will allow database elements to be related to each other, e.g., a database containing a ship's compartments where two compartments are adjacent.

This chapter has attempted to give a brief introduction to the concept and organization of DEX. For the

reader who is confused at this point by the large number of new ideas, terms and subprograms mentioned, Chapter 2 has been included to provide an example of a simple module which employs many of the concepts and subroutines described. It should give the reader a practical awareness of how this all ties together. This will prove helpful in reading the next five chapters which discuss the design of the extended DEX library subprograms. Chapter 8 discusses an application of DEX to computer-aided ship design. Finally, Chapter 9 offers recommendations for future work.

CHAPTER 2

THE CUBE MODULE SAMPLE PROGRAM

2.1 General Description

2.1.1 Function of the Module. The Cube Module was developed to test the subprograms of the extended DEX library written during this investigation. The module calculated the volume and weight of a block of salt water given the length, width, and height (note that "cube" is a slight misnomer). While that function itself was elementary, the combination of single, scalar values for length and width and an array for height (and also, therefore, for volume and weight) permitted the testing of the reading, editing and writing routines for real scalars and the reading and writing routines for real arrays. The subprogram for specifying input and output units employed the routines for integer scalars. The subroutines for determining the conversion factors for length, force and volume were also exercised. Finally, as a matter of course, the environment setting routines were also tested.

Appendix A contains a listing of the module.

2.1.2 Module Subprograms. Although no single, correct sequence of operating the module subprograms existed, there was a logical path one would follow to

execute the program when not attempting to test every available option of the module. This path is a convenient order in which to list the module subprograms and those extended DEX library subprograms involving menus:

```
MAINPG                  (C-M)
    DIALOG              (DL-M)
    SOURCE              (DL-M)
    DESTIN              (DL-M)
    MDMODE              (DL)
    MODIO               (C-M)
INPUT                   (C-M)
    MXUNIT              (C-M)
        LUNIT           (DL-M)
        FUNIT           (DL-M)
    DIMENS              (C-M)
COMPUT                  (C)
OUTPUT                  (C-M)
    VANDWT              (C-M)
BLOCK DATA              (C)
```

The "C" indicates a Cube Module subprogram, the "DL" indicates an extended DEX library subprogram and the "M" indicates that the subprogram included a menu. Figure 2-1 illustrates the menus encountered in this model.

2.1.3 Typical Operation. A description of a typical execution of the Cube Module should prove helpful. To assist the reader, Figure 2-2 shows the various access and return routes of the subprograms. Once the user entered the DEX level environment he activated the Cube Module via the "begin" option of menu "DEX.MAIN", that is

. begin cube

MENU MOD.MAIN
DIALOGUE
INMODE
OUTMODE
MOD.MODE
READ
EDIT
COMPUT
WRITE
QUIT

MENU MOD.ALTR
TERSE
VERBOSE

MENU SOURCE
DATABASE
TERMINAL
SCREEN
FILE
DEFAULT

MENU DESTINAT
DATABASE
TERMINAL
SCREEN
FILE

MENU MOD.IO
ALL
INPUT
OUTPUT
DONE

MENU INPUT
ALL
UNITS
DIMENSIO
DONE

MENU UNIT
ALL
LENGTH
TIME
FORCE
PLANEANG
TEMP

MENU FOR.UNIT
POUNDAL
FPOUND
SHORTTON
LONG TON
DYNE
NEWTON
KILOPOND

MENU LEN.UNIT
INCH
FOOT
STATMILE
NAUTMILE
MILLIMET
CENTIMET
METER
KILOMET

MENU DIMENSIO
ALL
LENGTH
WIDTH
HEIGHT
DONE

MENU OUTPUT
ALL
UNITS
RESULTS
DONE

MENU RESULTS
VOLUME
WEIGHT
DONE

Figure 2-1. Menus Encountered in Executing the Cube Module

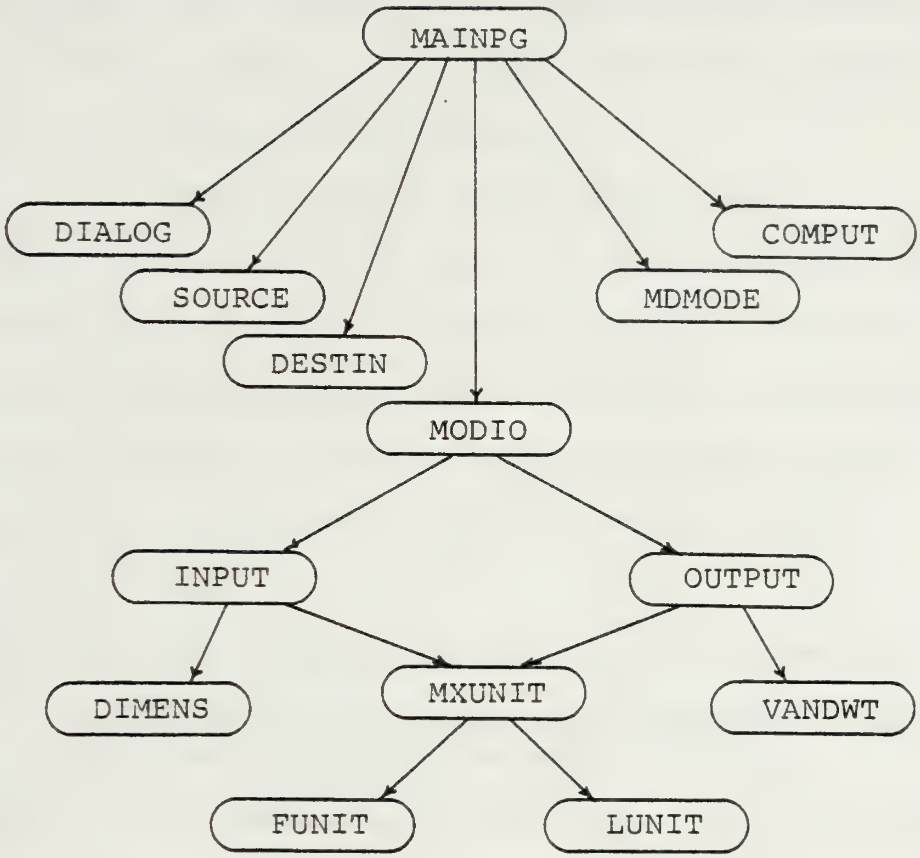


Figure 2-2. Access routes of the various subprograms encountered in executing the Cube Module. Return routes are back along the arrows.

where "cube" was the assigned module identification name. This command placed him in module subroutine MAINPG where he encountered the message:

*ENTER AN ITEM FROM MENU-MOD.MAIN

The user typed "mod.mode" and was presented with the status of the module environment. The initialized values for the dialogue, source and destination were verbose, terminal and terminal respectively and he found these satisfactory. He then typed

.read

which sent him to subroutine MODIO and the message

```
*SELECT WHICH MODULE VARIABLE SEGMENT TO READ
*ENTER AN ITEM FROM MENU-MOD.IO
```

From this menu he selected item "input" by typing it:

.input

Now in subroutine INPUT he received the instruction

```
*SELECT WHICH INPUT VARIABLE SEGMENT TO READ
*ENTER AN ITEM FROM MENU-INPUT
```

At this point, to save time, he made two sequential selections. From menu "INPUT" he selected "units" and anticipating menu "UNIT" he chose "length". He accomplished this by typing

.units length

DEX recognized the space between the two words as a delimiter between two commands. It acted on the first by invoking subroutine MXUNIT. It then located item

"length" on that subroutine's menu and called subroutine LUNIT which issued the command

```
*ENTER LENGTH UNIT TO BE USED DURING INPUT OUTPUT
*ENTER AN ITEM FROM MENU-LEN.UNIT
```

The user specified "foot". LUNIT then passed control back to subroutine MXUNIT which printed

```
*SELECT WHICH UNIT TO READ
*ENTER AN ITEM FROM MENU-UNIT
```

Again to save time, the user typed in two sequential menu selections:

```
.force fpound
```

This sent him to FUNIT and then back to MXUNIT. This time from menu "UNIT he chose item "done" which returned him to subroutine INPUT. Figure 2-3 illustrates this sequence.

At this point the user had defined the length and weight units he intended to use for input and output. In response to INPUT's request for a menu selection he typed

```
.dimensio
```

This invoked subroutine DIMENS and caused the following to be printed.

```
*SELECT THE DESIRED DIMENSION TO READ
*ENTER AN ITEM FROM MENU-DIMENSIO
```

The user intended to read in all three dimensions (he could have used any or all of the initialized values built into the module in BLOCK DATA) so he typed item

```
*ENTER AN ITEM FROM MENU - MOD.MAIN
.mod.mode
 *MODULE DIALOGUE            : VERBOSE
 *MODULE INPUT SOURCE        : THE TERMINAL (ALPHANUMERIC)
 *MODULE OUTPUT SOURCE       : THE TERMINAL (ALPHANUMERIC)
 *REFERENCE NUMBER FORM MODULE
 *FORTRAN READ FROM A FILE  : 3
 *FORTRAN WRITE TO A FILE   : 4
 *ENTER AN ITEM FROM MENU - MOD.MAIN
.read
 *SELECT WHICH MODULE VARIABLE SEGMENT TO READ.
 *ENTER AN ITEM FROM MENU - MOD.IO
.input
 *SELECT WHICH INPUT VARIABLE SEGMENT TO READ.
 *ENTER AN ITEM FROM MENU - INPUT
.units length
 *ENTER AN ITEM FROM MENU - LEN.UNIT
.foot
 *SELECT WHICH UNIT TO READ.
 *ENTER AN ITEM FROM MENU  - UNIT
.force fpound
 *SELECT WHICH UNIT TO READ.
 *ENTER AN ITEM FROM MENU - UNIT
.done
 *SELECT WHICH INPUT VARIABLE SEGMENT TO READ.
 *ENTER AN ITEM FROM MENU - INPUT
.dimensio
 *SELECT THE DESIRED DIMENSION TO READ.
 *ENTER AN ITEM FROM MENU - DIMENSIO
.all
 *ENTER LENGTH OF CUBE (FOOT        )
 *ENTER UP TO   1 REAL NUMBERS
.1.0
 *ENTER WIDTH OF CUBE (FOOT        )
 *ENTER UP TO   1 REAL NUMBERS
.1.0
 *ENTER HEIGHT OF CUBE (FOOT        )
 *ENTER UP TO   4 REAL NUMBERS
.1. 2. 3. 4.
 *SELECT WHICH INPUT VARIABLE SEGMENT TO READ.
 *ENTER AN ITEM FROM MENU  - INPUT
```

Figure 2-3. Sample Cube Module Input Sequence

"all". The computer responded with:

```
*ENTER LENGTH OF CUBE (FOOT        )
*ENTER UP TO 1 REAL NUMBERS
```

The user typed in "1.0" and the computer proceeded to the next instruction

```
*ENTER WIDTH OF CUBE (FOOT        )
*ENTER UP TO 1 REAL NUMBERS
```

The process was repeated, except that for height the computer requested up to four real numbers (height was defined as an array having up to four elements). When the desired number (say four) of heights were entered control returned to INPUT. The user then typed in

```
.done done
```

to return to subroutine MODIO and from there to subroutine MAINPG.

In response to this subroutine's instruction the user typed

```
.compute
```

This invoked the COMPUT subroutine to actually calculate the volumes and weights. Control was then returned to MAINPG as evidenced by the instruction

```
*ENTER AN ITEM FROM MENU-MOD.MAIN
```

By now comfortable with the operation of the module, the user decided to display his results on the terminal. He decided to retain "foot" and "poundforce" as the units, although he could have selected any desired

units by accessing MXUNIT again. The volumes and weights returned by COMPUT were in metric units, that being the system in which COMPUT was written. The conversions took place at the input/output locations. More on this later.

Now observe closely. The user issued the following commands:

.write output results all

These were selections from menus "MOD.MAN", "MOD.IO", "OUTPUT" and "RESULTS" respectively. The computer printed on the terminal the four volumes and four weights. Figure 2-4 is a copy of that printing.

Satisfied with his answers, the user responded to the current instruction from subroutine OUTPUT with

.done done

to get back to MOD.MAIN. Choice "quit" at this point caused him to leave the module level and return to the DEX level, facing menu "DEX.MAIN". The "quit" selection allowed him to exit DEX and reenter the operating system level in order to log off.

The rest of this chapter will describe the subprograms of the Cube Module to assist the reader in understanding how to write a module program.

```
*ENTER AN ITEM FROM MENU - MOD.MAIN
wr output results all
*VOLUME OF CUBE ( FOOT   **3    )
*     INDEX        VALUE
*        1     0.999999E+00
*        2     0.200000E+01
*        3     0.299999E+01
*        4     0.399999E+01
*WEIGHT OF CUBE ( POUND( FORCE))
*     INDEX        VALUE
*        1     0.638765E+02
*        2     0.127753E+03
*        3     0.191629E+03
*        4     0.255506E+03
```

Figure 2-4. Sample Cube Results
(as printed on terminal)

2.2 Frequently Used Subroutines

2.2.1 Block Data. We will commence the discussion of the module with the subroutines which may be used with only slight changes in form and/or content in several modules. The user may wish to refer frequently to the listings of these subroutines in Appendix A.

First is a special subprogram, BLOCK DATA, used as standard practice in Fortran to initialize all the labeled common blocks used throughout the module. With respect to input/output variables, a typical labeled

common block appearing in BLOCK DATA and the pertinent subprograms is as follows:

```
      COMMON /VINFO/ V(4),VOLNAM,VOLCMT,NDEVF,DEFALV(4)
```

From this we can identify the following information which should appear in BLOCK DATA:

(i) the variable (dimensioned for its maximum size if an array)

(ii) the variable database name

(iii) the variable database comment

(iv) the number of default values (if it is an array)

(v) the default value (or dimensioned default array)

These values would all be initialized in the BLOCK DATA. Locating the initialization and dimensioning of all input/output variables in one subprogram facilitates checking and is a highly recommended practice.

The variables are grouped under the subroutines in which they first appeared. MAINPG included four common blocks - REFNOS, INOUTF, DIALFG and MDNCPW. All of these are used in several other subprograms. REFNOS included the variables RNRFIL and RNWFIL which represented respectively the file reference numbers for reading from a sequential file using the Fortram READ command and writing to a sequential file via the Fortan WRITE

command. INOUTF included the variables IMODE and OMODE. The first denoted the source of reading information (1 = database, etc.) and the second denoted the destination for writing information (1 = database, etc.). DIALGF contained the logical variable MTERSE to denote the type of module dialogue (terse or verbose). Finally labeled common MDNCDW contained the integer variable NCPW which was the number of characters per word assumed by the DEX routines. This value was site dependent. For example on IBM computers it was 4. For this reason it was flagged in BLOCK DATA as site-dependent.

The other subroutines which represented the first occurrences of labeled common blocks were LUNIT, TUNIT, FUNIT, AUNIT, TPUNIT, DIMENS and VANDWT. Let us examine DIMENS. It contained nine labeled common blocks. The first four were mentioned above in MAINPG. LUNITS will be described in Chapter 7. The remaining four were listed under subroutine DIMENS in BLOCK DATA. LINFO, WINFO and HINFO contained the variable, database name, comment, default values and number of default values, where applicable, for the length, width and height dimensions respectively. H and DEFALH were dimensioned because they were arrays. The type declarations and dimensions of all the variables were followed by the

data declarations of their values. The remaining common block, DIMFRM, represented the formats to be used when reading from or writing to sequential files. One format was for real scalars and the other for arrays.

2.2.2 MAINPG. Subroutine MAINPG, via menu "MOD.MAIN", allowed the user to select the environment of the module and the desired paths to follow to operate it. The capabilities it gave the user were:

(1) To set the style of module dialogue. This choice invoked subroutine DIALOG.

(2) To select the source of module input. This choice invoked subroutine SOURCE. Remember that "input" here means any information to be read, even output variables.

(3) To select the destination of module output. This choice invoked subroutine DESTIN.

(4) To list the module flags. This invoked subroutine MDMODE which printed the status of the dialogue, the source, the destination, and the file reference numbers.

(5) To access the module reading routines. This choice set the variable IOFLAG=1 and then called MODIO.

(6) To access the module editing routines. This choice set IOFLAG=2 and then called MODIO.

(7) To access the module computing routine by calling COMPUT to execute the calculations.

(8) To access the module writing routines. This choice set IOFLAG=3 and then called MODIO.

(9) To return control to the DEX level and menu "DEX.MAIN". It did this by invoking the DEX routine ENDIT.

The menu name and the items were declared in MAINPG with data statements. DEX routine MENUIN was used to convert the user's selection to an integer flag ITEM for branching to the correct point in MAINPG. MENUIN was the routine that actually printed the prompting instruction to enter a menu item.

The user can make his subroutine MAINPG as simple or extensive as desired within the constraint that the maximum number of menu items (because of MENUIN) is twelve. To show how simple it could be, consider a user who has a program called STRENGTH and for some reason he wanted to start it with the DEX. All he would need in his module besides STRENGTH is the following subroutine:

```
SUBROUTINE MAINPG
CALL STRENGTH
RETURN
END
```

If STRENGTH used menus, DEX routine ENDIT would also have to be called to clear the buffer afterwards.

2.2.3 MODIO. Subroutine MODIO had one parameter in its calling sequence - IOFLAG - which indicated if the operation to be performed was reading, editing and writing. MODIO had two labeled commons - DIALGF and MDNCPW - discussed in BLOCK DATA. DIALGF determined whether the verbose or terse menu prompting message would be issued. NCPW was needed for calling DEX routines STRPAK and LMOVEC.

MODIO presented the user with the menu selections shown in Figure 2-1. The "all" option allowed the user to read, edit or write all the input and output variables. The "all" option was implemented by a logical variable "ALLFLG" which was set to .TRUE if that menu item was chosen. This variable was subsequently passed on through the module. If it was returned .FALSE. to MODIO, it would cause the execution of the last command to be halted and the prompting message for menu "MOD.IO" to be issued so that the user could take corrective action.

2.2.4 MXUNIT and the "ALL" Logic. A subprogram similar to MXUNIT will be needed in any module which allows the user to specify i/o units different from those in which the computing routines were written. MXUNIT permitted the user to read, edit or write the module units he wished to use for input and output. For example, if the user selected "force" from menu "UNIT", subroutine FUNIT

would have been called to present the menu choices for force units. FUNIT and the others in that series will be described in Chapter 7, but some detail is required here because of all the calling parameters involved.

The calling sequence for FUNIT, typical for all five in that series, was as follows:

```
CALL FUNIT(UIFUN,LOCALL,IOFLAG,IOMODE,MTERSE,
           NCPW,DBFUNN,DBFUNC,PMPREP,PMES,
           RNFILE,FUNFRM,DEFFUN)
```

The first parameter was an output variable, LOCALL was both input and output, and the rest were all input variables provided by MXUNIT.

UIOFUN would have been assigned a value between 1 and 7 depending on what force unit the user selected.

LOCALL carried the information concerning the "ALL" option. One of the calling parameters for MXUNIT, CALALL, passed on the "ALL" option from subroutine INPUT. If it was .TRUE. then LOCALL would have immediately been assigned .TRUE. also, and the prompting for menu "UNIT" would have been bypassed. Each of the i/o unit-defining routines, such as FUNIT, would have been called and the user asked to specify the desired choice of the particular type of unit. Even if CALALL was .FALSE., the user could have selected "all" from menu "UNIT" with similar results.

If any of the i/o unit-defining subroutines was unsuccessful, LOCALL would have been returned .FALSE.. The program would have checked the value of CALALL. If it too was .FALSE., the menu "UNIT" would have been presented for another selection. However, if CALALL was .TRUE., it would have meant that there had been a change in the value of LOCALL (i.e., a failure in the called subprogram). MXUNIT would have set CALALL to .FALSE. and returned control through subroutine INPUT back to MODIO. This was because INPUT incorporated the same "ALL" logic as MXUNIT.

Note from the listing of MXUNIT that LOCALL is initialized as .FALSE.. If CALALL was .FALSE. and the user did not choose "all" from menu "UNIT", he would have been asked to select from the menu each time after a unit was specified, until he typed "done". This "ALL" logic was used extensively throughout the module as a means of expeditng the reading, editing or writing of many variables.

Returning to the calling sequence for FUNIT, we have already mentioned IOFLAG, indicating the operation to be performed. PMPREP was set locally by a data declaration. It indicated to the subprograms called whether or not a prompting message for the unit to be selected was to be prepared by the program. If .TRUE., PMES would later be the storage location for the prompting message. If

PMPREP was .FALSE., PMES would already have to have the prompting message in it. Since PMES first appeared here in MXUNIT it was dimensioned here for the maximum allowable size of 16 "words". This number came from the limitation on PMES to be at most 64 characters long, divided into 4-character "words".

All the other variables were obtained by MXUNIT from other subprograms, including BLOCK DATA, by labeled common blocks. An inspection of the listing of MXUNIT reveals the large number of commons required because of five types of units.

INOUTF passed the indicator of the source of information to be read (IMODE) and the destination of information to be written (OMODE). Depending on IOFLAG, IOMODE was set equal to one of these two. This told FUNIT from where UIOFUN was to be read or to where UIOFUN was to be written.

REFNOS passed the values of the file reference numbers for Fortran READ (RNRFIL) and Fortran WRITE (RNWFIL). Depending on IOFLAG, RNFILE was set equal to one or the other. These values are assigned to files during the execution of extended DEX library routines SOURCE and DESTIN by DEX routine SETDEV if the user had designated files as the source or destination.

The other labeled commons will be described in Chapter 7.

2.3 The Input Series

2.3.1 INPUT. Subroutine INPUT provided the user with a menu by which he could access subroutines MXUNIT and DIMENS and return control to subroutine MODIO. It contained the labeled common blocks DIALGF and MDNCPW for use in calling STRPAK and LMOVEC for character manipulation. INPUT had two variables in its calling sequence - CALALL and IOFLAG - as did MXUNIT described above. The logic for the use of CALALL and LOCALL was identical to that described in 2.2.4. Briefly, if LOCALL was set to .TRUE. when INPUT was invoked because CALALL=.TRUE., and it was returned by MXUNIT or DIMENS as .FALSE., CALALL would have been set equal to .FALSE. and control passed back to MODIO. If CALALL was .FALSE., LOCALL would have been .FALSE. unless the user selected "all" from menu "INPUT".

Besides LOCALL, INPUT passed IOFLAG to MXUNIT and DIMENS to indicate reading, editing or writing.

2.3.2 DIMENS. Subroutine DIMENS allowed the user to read, edit, or write the value of the block dimensions. It had two calling parameters, ALLFLG and IOFLAG. The former carried the "ALL" option information and behaved like CALALL. The "ALL" option was passed on to the called logical functions by the usual variable LOCALL.

DIMENS, like MXUNIT, also contained quite a few labeled common blocks. Five have already been seen in

MXUNIT: DIALGF, INOUTF, MDNCPW, REFNOS, and LUNITS. LINFO, WINFO, and HINFO contained the variable, database name, comment and default values for the length, width and height of the block. DIMFRM contained the format information for reading from or writing to files.

Before menu "DIMENSIO" was presented to the user, two actions occurred. The first was the calling of the logical function UNITLF by the statement

```
LOGVAL=UNITLF(CONVLM,NAMLØ2,NAMLØ6,NAML12,ALLFLG,
              PSTLUN,UIOLUN,NCPW)
```

UNITLF, discussed in Chapter 7, produced the multiplicative conversion factor CONVLM for converting the dimensions in the input length unit to values in the program standard length unit (meter). The second through fourth variables in UNITLF's calling sequence represented various abbreviations of the length unit the user had selected for input/output. UNITLF was able to provide this information because of the values of PSTLUN and UIOLUN. The first indicated program standard length unit, the second user i/o length unit. As a pair they were an index to locating the other information.

The other action which occurred immediately in DIMENS was the setting of LOCALL equal to ALLFLG. If this made LOCALL equal to .TRUE., menu "DIMENSIO" was not presented and DIMENS immediately started operating on all the menu choices.

If the user selected "width" from the menu, the program next referred to IOFLAG. If IOFLAG=1 (reading), the program branched to the statement

```
LOGVAL=RSCLDR(W,LOCALL,MTERSE,IMODE,NCPW,WIDNAM,
              CONVLM,CONVLA,NAML12,.FALSE.,.TRUE.,
              PMES,WMORGN,RNRFIL,LWFRM,DEFALW)
```

Logical function RSCLDR is the first of three functions for reading real scalars. The value read in for width, in program standard units, was stored in W. IMODE indicated the source of the reading. WIDNAM was the 8-character database name for width. CONVLM and CONVLA were respectively the multiplicative and additive conversion factors for changing the read in width to the value in program standard units via the expression

```
W=W * CONVLM + CONFLA
```

CONVLA was locally declared 0. NAML12 was the 12-character version of the i/o length unit and was used in prompting message preparation and database comment comparison. The parameter .FALSE. represented the variable VITAL which indicated if the variable W was essential for input continuation. The parameter .TRUE. was for PMPREP, indicating that the reading subprograms would prepare the prompting message PMES, at this point undefined. Since PMES was a local variable not passed to DIMENS by the calling sequence or a labeled common block it was dimensioned "16" in DIMENS. WMORGN contained the description

of the width, including space allotted for inserting the units. RNRFIL and LWPRM were the reference number and format respectively for reaching width from a file. DEFALW was the default value for width if the user wished to set W equal to that.

If IOFLAG=2, the subprogram called the editing routines by the expression

```
LOGVAL=RSCEDT(W,LOCALL,MTERSE,NCPW,WIDNAM,CONVLM,
              CONVLA,NAML12,.TRUE.,PMES,WMORGN,
              RNRFIL,LWFRM,DEFLAW)
```

This was very similar to the reading function except that IMODE was not specified. This was because RSCEDT itself defined and employed a variable EDMODE, of value 2, for the terminal, in lieu of IMODE, when it called RSCLDR.

Finally, if IOFLAG=3, the real scalar writing routines were invoked by the statement

```
LOGVAL=RSCDMP(LOCALL,MTERSE,OMODE,NCPW,W,WIDNAM,
              CONVLM,CONVLA,NAML12,.TRUE.,PMES,
              WMORGN,RNWFIL,LWRFM)
```

Observe that OMODE was used to indicate destination of the value of W for writing. Also note the use of RNWFIL to indicate the file reference number for writing with Fortran WRITE, using the format supplied by LWFRM.

Because the height variable H represented a four-element array, the logical functions called were different. For reading (IOFLAG=1) DIMENS branched to the statement

```
LOGVAL=RA1LDR(H,LOCALL,NGOT,MTERSE,IMODE,NCPW,HEINAM,
              MXTOGT,CONVLM,CONVLA,NAML12,.FALSE.,
              .TRUE.,PMES,HMORGN,RNRFIL,HFRM,NDEFH,
              DEFALH)
```

Several new variables appear here. MXTOGT represented the maximum number of elements to extract from the source when the source was a database or the terminal. NGOT represented the actual number of elements read from the source. Both MXTOGT and NGOT were initialized as 4 in DIMENS. VITAL was defined by the .FALSE. and PMPREP by the .TRUE.. HFRM contained the format for reading the array from a file. NDEFH and DEFALH were respectively the number of default values and a four-element array containing the default values for height.

Because the array editing routines had not yet been written, provision for calling a dummy routine, RAREDT, was included in DIMENS.

For writing (IOFLAG=3), the program branched to

```
LOGVAL=RARDMP(LOCALL,MTERSE,OMODE,NCPW,H,HEINAM,
              NFROM,NGOT,CONVLM,CONVLA,NAML12,
              .TRUE.,PMES,HMORGN,RNWFIL,HFRM)
```

NGOT, mentioned above, and NFROM, were initialized as 4 and 1 respectively in DIMENS. NGOT could have a value different from 4 only if less than four elements were read in when RA1LDR was called.

2.4 The Output Series Subprograms

The output series consisted of two subprograms - OUTPUT and VANDWT - for working with the volumes and weights calculated by COMPUT. These had direct parallels to INPUT and DIMENS and need not be discussed in detail. OUTPUT offered the user the capability of invoking MXUNIT, via the menu item "unit", in case the user wished to write the volume and weight in different units from those he had used for reading in the block dimensions.

2.5 General Programming Comments

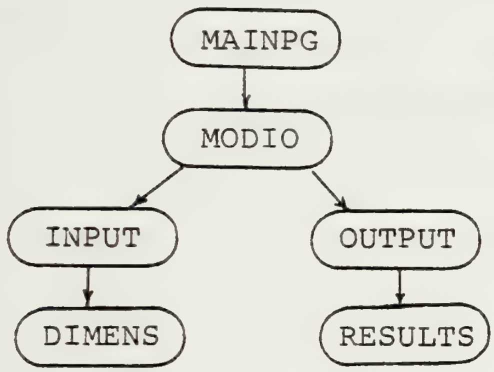
This chapter will conclude with some comments about writing modules. It is hoped that the reader has some understanding of the calling parameters used by module subprograms when invoking extended DEX library routines. In some cases large numbers of variables appear in the calling sequences. This is due to the fact, as will be pointed out in the next chapter, that the library routines use no common blocks.

One suggestion already emphasized is the use of a BLOCK DATA subprogram to initialize all input/output variables and their associated variables. This adds some extra work by increasing the number of common block variables, such as the database names, comments and default values. However, the improved efficiency for checking values and dimensions is considered to outweigh this disadvantage.

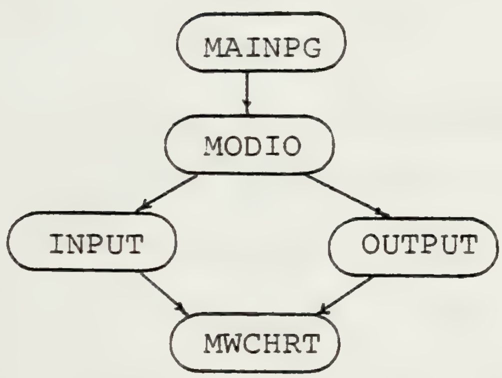
When writing a module, to determine the menus required it is easiest to work backwards in the opposite direction to the order of use. Identify the input and output variables and place them in menus. Then establish a supervisory input menu and a supervisory output menu. For example, one may contain the group name for the input variables, such as "dimensions" in Cube, plus a units item to allow the user the choice of i/o units. At this point the module author may be almost done with the module design phase, because he can frequently incorporate the standard routines MAINPG and MODIO to complete his set. MXUNIT is also offered as a very adaptable, comprehensive routine for handling units. In a situation like the Machinery Weight Estimating Module in Chapter 8, one menu suffices for both input and output variables. Figure 2-5 illustrates the difference in flow between the main subroutine and the i/o variables for the two modules. Yet both use identical MAINPG and MODIO subprograms and only slightly different versions of MXUNIT.

When establishing menus a few rules must be kept in mind. The maximum number of menu items is twelve. When constructing the eight character menu item names, no blanks are allowed between characters but are acceptable after all the characters. If each menu item begins with a different character, only that one character has to be

entered by the user to enable DEX routine MENUIN to identify the selection.



Cube Module



Machinery Weight Estimating Module

Figure 2-5. Comparison of Module Input/Output Flow

CHAPTER 3

THE EXTENDED DEX LIBRARY ENVIRONMENT SETTING ROUTINES

3.1 Introduction

Upon entering the module level of DEX operation, the user needs to establish or verify the environment which suits his requirements. Four extended DEX library subroutines give him the capability to do this. They are:

(1) DIALOG, which sets the type of module dialogue

(2) SOURCE, which defines the location of information to be read

(3) DESTIN, which defines the location to which information is to be written

(4) MDMODE, which displays on the terminal the current status of the type of dialogue, the source, the destination and the file reference numbers for Fortran READ and WRITE to sequential files.

Each of these will be discussed in this chapter. Logical function CHKRNG, revised during this investigation, is also discussed here, although it will eventually become a DEX routine and not an extended DEX library function.

3.2 Subroutine DIALOG

3.2.1. Menu and Calling Parameter. Subroutine DIALOG would normally be called by a subroutine similar to the

subroutine MAINPG of the Cube Module. In that specific case it was done by selecting item "dialogue" from menu "MOD.MAIN". DIALOG has its own menu, and this is illustrated in Figure 3-1. Note the absence of an item "done",

```
$     + -------- +
$     +   MENU   +
$     + MOD.ALTR +
$     + -------- +
$   1 + TERSE    +
$     + -------- +
$   2 + VERBOSE  +
$     + -------- +
```

Figure 3-1. Menu "MOD.ALTR"
(for Subroutine DIALOG)

which appeared in most of the Cube Module menus. This is typical for the subroutines of this chapter. Since the user only makes one choice from these menus, the subprograms automatically return control to the calling program (e.g. MAINPG) without further action by the user.

It should also be called to the reader's attention that the DEX library subroutines employ no labeled common blocks. Rather, all variable values are transmitted by means of the calling sequences. This was done to minimize the possibility of inadvertently passing improper values among the many subprograms which share the same commons. The calling sequence presents a readily-checked format for tracing errors.

The only variable in the calling sequence for DIALOG is the logical variable MTERSE. If MTERSE=.TRUE., the dialogue type is terse; it is is .FALSE. the dialogue is verbose. These two types of dialogues are offered to satisfy the needs of the individual user. For the new user, the verbose dialogue provides longer messages from the module or DEX to facilitate learning how to use them. The terse dialogue allows more rapid operations by the experienced user.

Initialized in BLOCK DATA, MTERSE can have its value changed by the correct selection from menu "MOD.ALTR". This is accomplished by subroutine MENUIN. MENUIN is a

DEX integer function (see reference [5]) which converts a menu selection into an integer value. In DIALOG, the following statements are involved in this process:*

```
      DATA LMS/8/
      DATA MENUNM/4HMOD.,4HALTR/
      DATA NITEMS/2/
      DATA ITEMS/4HTERS,4HE    ,
     1          /4HVERB,4HOSE /
      CALL STRPAK (MESS,LMS,4H<    ,29HSELECT TYPE OF MOD
     1ULE DIALOGUE<)
      ITEM=MENUIN(MENUNM,NITEMS,ITEMS,MESS)
```

MENUIN prints both the prompting message MESS shown above and the message

*ENTER AN ITEM FROM MENU - MOD.ALTR

MENUIN sets ITEM equal to 1 if the user selects TERSE and 2 if he selects VERBOSE. ITEM is then used to branch to statements which make MTERSE either .TRUE. or .FALSE. as appropriate. Both branches return control to the calling program.

3.3 Subroutine SOURCE

3.3.1 <u>Menu and Calling Sequence</u>. Subroutine SOURCE, normally accessed from a subprogram like MAINPG, allows the user to select from the menu shown in Figure 3-2 the source of information to be read. Subroutine MENUIN assigns a value between 1 and 5 to IMODE depending on the user's choice.

* STRPAK is a DEX routine which inserts character strings into an integer array in the DEX format of four characters per word. See ref [5].

The calling sequence for SOURCE is as follows:

```
SUBROUTINE SOURCE(IMODE,DBFNME,IFILNM,RNRFIL,
                  MTERSE,NCPW)
```

DBFNME is the database filename when the source is a database. IFILNM is the name of the sequential file if the user intends to read from a file. RNRFIL is an input variable defined in BLOCK DATA which represents the device number to be assigned to file IFILNM. The information in the file will be read in by one of the reading routines using the statement of the form

```
READ (RNRFIL, FORMAT) X
```

where X represents the variable being read. MTERSE and NCPW are required here for the preparation of the menu prompting message and other error messages supplied by subroutine source.

```
$     + -------- +
$     +   MENU   +
$     + SOURCE   +
$     + -------- +
$   1 + DATABASE +
$     + -------- +
$   2 + TERMINAL +
$     + -------- +
$   3 + SCREEN   +
$     + -------- +
$   4 + FILE     +
$     + -------- +
$   5 + DEFAULT  +
$     + -------- +
```

Figure 3-2. Menu "SOURCE"

3.3.2. Operation of SOURCE. SOURCE commences execution by calling MENUIN to prompt the user to make a menu selection. MENUIN assigns an appropriate value to IMODE for branching.

If IMODE=1, the subroutine requires a database via DEX logical function DBOPEN. If there already is an open database, DBOPEN asks the user if he wants to use it, and if so, if he wants to save it ("save" has the usual meaning of writing a copy into memory from the buffers) before using it. If a database is "active", meaning a copy is in the buffers but there is also a saved copy in memory, the user is asked only if he wants to use it. If the user answers "no" to either of these questions, or if there is no active or open database, DBOPEN prompts the user for the name of either a new one to be created or an existing one to be opened. DBFNME is assigned that name. When this is done control is returned to the calling program.

If IMODE=2 (terminal) or 5 (default values) control simply returns to the calling program. If IMODE=3, indicating that the user hoped to employ DEX routines to read X-Y coordinates from a screen plot, he is informed that this mode of module input has not been implemented yet.

IMODE=4 causes the calling of subroutine GETFLNM which asks the user the name of the sequential file to be

read. Then logical function SETDEV assigns RNRFIL to IFILNM before control returns to the calling program.

3.4 Subroutine DESTIN

3.4.1 Menu and Calling Sequence. Subroutine DESTIN is similar to SOURCE except that there are only four possible choices, as seen in the menu illustration in Figure 3-3. The calling sequence contains six parameters:

```
SUBROUTINE DESTIN(OMODE,DBFNME,OFILNM,RNWFIL,
                  MTERSE,NCPW)
```

OMODE is assigned a value between 1 and 4 by MENUIN. DBFNME is the same as in SOURCE. OFILNM is the name of the sequential file to which output is to be written. RNWFIL is an input variable defined in BLOCK DATA which represents the file reference number to be assigned to OFILNM for Fortran WRITE.

3.4.2 Operation of DESTIN. This subroutine behaves very similarly to SOURCE. If OMODE=1, DBOPEN checks for and opens as necessary a database and assigned DBFNME its name. If OMODE=2, control simply returns to the calling program. If the user selected the screen in order to do plotting, he is informed that this mode of output has not yet been implemented and is asked to make another selection. If OMODE=4, the user is asked the file name and it is assigned to OFILNM. Then logical function SETDEV assigns RNWFIL to the file and control is returned to the calling program.

```
$     + -------- +
$     +   MENU   +
$     + DESTINAT +
$     + -------- +
$   1 + DATABASE +
$     + -------- +
$   2 + TERMINAL +
$     + -------- +
$   3 + SCREEN   +
$     + -------- +
$   4 + FILE     +
$     + -------- +
```

Figure 3-3. Menu "DESTINAT"
(for Subroutine DESTIN)

3.5 Subroutine MDMODE

3.5.1 Function. Subroutine MDMODE informs the user of the current value of the following variables:

(1) MTERSE, which denotes the type of module dialogue

(2) IMODE , which denotes the source of information to be read

(3) OMODE , which denotes the destination of information to be written

(4) RNRFIL, which denotes the file reference number for module Fortran READ from a sequential file

(5) RNWFIL, which denotes the file reference number for module Fortran WRITE to a sequential file

After displaying this information, or an error message if a failure occurs, MDMODE returns control to the calling program.

3.5.2 Operation of MDMODE. The calling sequence for MDMODE contains only variables already discussed.

```
SUBROUTINE MDMODE(IMODE,OMODE,RNRFIL,RNWFIL,
                  MTERSE,NCPW)
```

MDMODE does not display the numerical values of IMODE and OMODE but rather, for the user's convenience, it prints character strings defining the source and destination, e.g. "a dex created database". Similarly, for MTERSE, it prints "terse" and "verbose" vice ".TRUE." or ".FALSE.".

3.6 Logical Function CHKRNG

Logical function CHKRNG determines if an integer number is within the range defined by two other integer numbers. If not, an appropriate error message is issued and CHKRNG is returned .FALSE.. The calling sequence is as follows:

```
LOGICAL FUNCTION CHKRNG(NUMBER,MNEMON,MINNUM,
                        MAXNUM,NCPW)
```

The routine checks if NUMBER is between the lower number MINNUM and the higher number MAXNUM. MNEMON is an 8-character memonic for NUMBER used in the error message. The use of CHKRNG avoids the need for the module author to include a message in his program.

CHAPTER 4

THE EXTENDED DEX LIBRARY READING ROUTINES

4.1 General Description

4.1.1 Function. Information, which includes both input values and previously calculated output values, resides in four locations: DEX-created databases, the user himself, requested files and default data stored in the module. The user actually presents two distinct sources of information to the computer because of the two ways in which he can transmit data at the terminal: the first in the form of alphanumeric characters and the other by the location of a pen-pointer or cross-hairs on a plot on the screen. The latter method has not yet been implemented in DEX at MIT.

The function of the extended DEX library reading routines is to permit the transmission of that information to the module so that it can be written to other locations, such as the terminal for inspection, and/or used as input for the calculations being performed.

4.1.2 Organization. Eight logical functions comprise the reading routines group. They are listed here by the type of variable on which the operate:

Integer Scalar	Real Scalar	Real Array
ISCLDR	RSCLDR	RA1LDR
ISCPMP	RVAPMP	
ISREAD	RSREAD	RA1RED

The real scalar and array categories share RVAPMP.

These routines could be categorized horizontally by their specific jobs, as evidenced by the similarities in their names. The top three are called "loaders". These are the functions that appear in the module sub-programs where it is desired to read variables, and to the module author, for all intents and purposes, they are the reading routines. He does not need to be aware that they actually call the others to do the work.

If the user intends to input from the terminal he needs to be prompted for the correct information. This prompting message can be supplied by the module or it can be prepared by two routines in this group called "prompters". The loaders call the prompters as they are required. Having ensured that a prompting message exists, the loaders then call the third category, the "readers", to actually read in and assign the values to the input. output and working variables.

4.2 Integer Scalar Series

4.2.1 ISCLDR

4.2.1.1 Calling sequence. The calling sequence for logical function ISCLDR includes 17 variables listed here:

```
  LOGICAL FUNCTION ISCLDR(IVAR,ALLFLG,
                          MTERSE,IOMODE,NCPW,DBNAME,VITAL
                          MENUFL,MENUNM,NITEMS,ITEMS,PMPREP,
                          PMES,PMORGN,RNFILE,FORMAT,DEFALT)
```

From the point of view of the function, IVAR is an output variable, ALLFG is both input and output, and the remainder are all input variables.

IVAR is where the value of the integer sought will be stored. VITAL should be discussed next. An essential input variable, that is one required when reading input so that subsequent values can be entered correctly, is indicated when the logical variable VITAL has a value .TRUE.. This is important to the value of ALLFG. ALLFLG indicates the status of the calling program "all" option (active when ALLFLG=.TRUE.). If both VITAL and ALLFLG are .TRUE. and IVAR is not read successfully, or the prompting message is not prepared successfully, ALLFLG will be changed to .FALSE.. ALLFLG's value can also be changed to .FALSE. during a reading evolution if IOMODE=4 (file source) and a premature end-of-file is encountered. Otherwise ALLFLG will retain its input value.

MTERSE indicates whether the module dialogue is terse or verbose. IOMODE denotes the source of input and corresponds to IMODE in the calling program. NCPW is the number of characters per word assumed by the DEX routines. DBNAME is where the database name of the integer is stored. Eight characters (including blanks) must be defined for this variable.

MENUFL is a logical variable which indicates if the integer sought will be a menu selection. If it is .TRUE., the next three variables must be defined. MENUNM is the eight-character name of the menu from which the selection will be made. NITEMS is the number of items in the menu. In the current version of DEX, the maximum number of menu items allowed is 12. ITEMS are the menu choices. Each choice is described by a name of eight characters (including blanks). Therefore, with four characters per word, ITEMS must be dimensioned as twice NITEMS where it first appears. The reader may wish to refer to the AUNIT series routines of Chapter 7 as examples of where menus are used to define integer values.

PMPREP is a logical variable which, when .TRUE., indicates that function ISCPMP will prepare the prompting message for the menu or INTIN. INTIN is a DEX routine which reads integer values entered from the terminal.

If PMPREP=.FALSE., the calling program supplies the prompting message in PMES.

PMES can be up to 64 characters long, and if less than 64 characters it must include the trim character, "<", last to signal the end of the string. Note that if PMPREP=.TRUE., PMES is undefined in the calling sequence of ISCLDR.

PMORGN ("prompting message origin") is a character string, usually the database comment, which identifies the variable sought. Like PMES, it must be 64 characters or less long and must include the trim character at its end if less than 64. When IOMODE=1, PMORGN will be compared with the database comment and differences brought to the user's attention.

RNFILE, corresponding to RNRFIL of the calling program, is the device number for Fortran READ if the integer is to be read from a file. FORMAT is the format for reading from the file. DEFALT is the default value of the integer sought when IOMODE=5.

4.2.1.2 Characteristics. When the source of the integer is the terminal, ISCLDR invokes routine CHKRNG to verify that NITEMS is between 1 and 12 inclusive when MENUFL=.TRUE.. If PMPREP=.TRUE., ISCLDR invokes ISCPMP to prepare the prompting message. If ISCPMP is returned .FALSE., ISCLDR is also set to .FALSE. and

control returns to the calling program. Otherwise, for terminal input, as well as database, file and default value input, ISCLDR calls logical function ISREAD to do the reading. ISCLDR is set to .TRUE. or .FALSE. depending on the similar value of ISREAD and control returns to the calling program.

ISCLDR becomes .FALSE. if ISCPMP or ISREAD fails. It also becomes .FALSE. if the programmer has bypassed previous checks and set IOMODE=3. The user is informed by ISCLDR that integer scalars cannot be read in from a screen supplying x-y coordinates. The subprogram then checks VITAL and if .TRUE., it advises the user that the variable is essential for program continuation and must be corrected. Then, if ALLFLG=.TRUE., it is changed to .FALSE. and the user is advised that the calling program "all" option is aborted. ISCLDR is set to .FALSE. and control returns to the calling program.

4.2.2 <u>ISCPMP</u>

4.2.2.1 <u>Calling sequence</u>. Logical function ISCPMP is used to prepare a prompting message suitable for identifying the integer being sought when the source is the terminal (IOMODE=2) and PMPREP=.TRUE.. The calling sequence for this function is as follows:

```
LOGICAL FUNCTION ISCPMP(PMES,ALLFLG,MTERSE,NCPW,
                        DBNAME,VITAL,MENUFL,PMORGN)
```

These parameters have been described in section 4.2.1.1 PMES is the output variable where the prompting message sought is stored. MTERSE is needed here to determine whether a brief or long message is to be prepared. MENUFL is included here but presently it is not used by ISCPMP.

4.2.2.2 Characteristics. ISCPMP creates the prompting message by insering the word "ENTER", followed by a short or long description of the variable depending on MTERSE, into PMES. When the dialogue is verbose, PMORGN is used as the indentifying string. The program scans it for the location of the trim character to determine its length. If the string is 51 characters or less, the message can be fit on one line. "ENTER" and "PMORGN" are copied into PMES. If, however, PMORGN has more than 64 characters, the prompting message must be two lines long. The word "ENTER" is printed immediately and PMORGN alone is copied onto PMES, to be printed by ISREAD.

When the dialogue is terse, PMES is created from "ENTER" and the database name, DBNAME, with a trim character added at the end.

If a failure occurs in preparing the prompting message, an error message is used. Then, when VITAL= .TRUE., the user is advised that the variable is

necessary for program input continuation and the problem must be corrected. When both VITAL and ALLFLG are .TRUE., the later changes to .FALSE. and the program advises the user that the calling program "all" option is aborted. Finally, ISCPMP is set to .FALSE. and control returns to ISCLDR. If the message preparation is successful, ISCPMP is set to .TRUE. before returning control to ISCLDR.

4.2.3 ISREAD

4.2.3.1 Calling sequence. Logial function ISREAD actually does the reading of the integer from the source defined by IOMODE. The calling sequence for ISREAD is as follows:

```
LOGICAL FUNCTION ISREAD(IVAR,ALLFLG,
                        MTERSE,IOMODE,NCPW,DBNAME,VITAL
                        MENUFL,MENUNM,NITEMS,ITEMS,
                        PMES,RNFILE,FORMAT,DEFALT)
```

It is almost identical to ISCLDR, the difference being that PMPREP is no longer needed. PMES should be defined here and it must include the trim character if not 64 characters long.

4.2.3.2 Characteristics. ISREAD branches depending on the value of IOMODE. If the source of the integer is a database (IOMODE=1), ISREAD extracts the value using the DEX integer function IGET (see reference [5]). IGET provides error codes which, if other than

success, cause appropriate error feedback messages to be issued.

When IOMODE=2 (terminal input), and MENUFL=.TRUE., routine MENUIN is invoked to obtain IVAR from the menu selection. When a menu is not employed, DEX routine INTIN prompts the user to supply the integer value and reads what is entered at the terminal.

For IOMODE=4 (file source), ISREAD uses a Fortran READ statement, involving RNFILE and FORMAT, to read from the file. The program issues a warning if a premature end-of-file is encountered.

Whenever an error occurs in the reading, or if the user insists on trying IOMODE=3, VITAL and ALLFLG are checked. A warning that the variable is essential for program continuation is issued when VITAL=.TRUE.. ALLFLG will then be set to .FALSE. if not already. ALLFLG's value will also be changed, even if the variable is not essential, if either no open database was found (IOMODE=1) or a premature end-of-file is encountered (IOMODE=4), since further attempts at reading from these sources would be fruitless. In all cases of errors, ISREAD is set to .FALSE. and control is returned to the calling program. When the reading is successful, ISREAD is set to .TRUE..

4.3 Real Scalar Series

4.3.1 Brief description. The function of this group of routines is to permit the user to read real scalar values from any of the designated sources. Three logical functions make up this series: RSCLDR, RVAPMP and RSREAD. RVAPMP prepared prompting messages for reading both real scalars and real arrays from the terminal.

4.3.2 RSCLDR

4.3.2.1 Calling sequence. Logical function RSCLDR is invoked from the module. Its calling sequence is as follows:

```
  LOGICAL FUNCTION RSCLDR(RVAR,ALLFLG,
                          MTERSE,IOMODE,NCPW,
                          DBNAME,UNITFM,UNITFA,UNITNM,VITAL
                          PMPREP,PMES,PMORGN,RNFILE,FORMAT,
                          DEFALT)
```

Many of these variables are identical to those used in ISCLDR.

RVAR will be assigned the value, in program standard units, of the real number to be read. UNITFM and UNITFA are respectively the multiplicative and additive conversion factors which convert the real scalar read from the user input/output units to the program units. The conversion occurs in RSREAD. UNITNM is a 12-character version (including blanks) of the user i/o units, which is used in preparing the prompting message. If the real

scalar is not dimensional, UNITFM must be equal to 1.0, UNITFA must equal 0.0 and UNITNM is undefined.

PMORGN contains a string of 64 characters or less which identify the variable sought. If it has less than 64 characters it must have the trim character at the end of the string. If the real variable has units, PMORGN should contain the string "(????????????)" into which UNITNM is inserted at the appropriate time. PMES must be dimensioned sufficiently large to accomodate PMORGN plus 6 characters (for "ENTER ") or 64 characters, whichever is less.

4.3.2.2 <u>Characteristics</u>. RSCLDR behaves similarly to ISCLDR. If the source is the terminal and PMPREP=.TRUE., it calls RVAPMP to prepare a prompting message. When the preparation is unsuccessful, RVAPMP is returned .FALSE.. RSCLDR becomes .FALSE. also and control returns to the calling program. If, however, the message preparation is successful, or for IOMODE=1, 4 or 5, RSCLDR calls RSREAD to read the real value. RSCLDR is set to .TRUE. or .FALSE. depending on the success or failure of RSREAD.

When IOMODE=3, RSCLDR informs the user that reading x-y coordinates from a graph on the screen in inappropiate for real scalar input. If VITAL=.TRUE., it issues an

advisory message to the user that the variable is essential for program continuation. ALLFLG is changed to .FALSE. if not already, with a warning that the "all" option is aborted, RSCLDR is set to .FALSE., and control returns to the calling program.

4.3.3 RVAPMP

4.3.3.1 Calling sequence. Both RSCLDR and RAlLDR invoke RVAPMP to prepare a prompting message for real scalars and real arrays respectively. The calling sequence is:

```
LOGICAL FUNCTION RVAPMP(PMES,ALLFLG,
                        MTERSE,NCPW,DBNAME,UNITNM,VITAL,
                        PMORGN)
```

These parameters are identical to those for ISCPMP except for UNITNM which carries the user i/o unit to be inserted into PMES.

4.3.3.2 Characteristics. When RVAPMP is invoked, PMORGN is scanned for the location of the trim character and for the string "(???????????)" called UNITPT. The presence of UNITPT indicates that the variable is dimensional.

When the dialogue is verbose, the prompting message will be one line long if the trim character is found before the 59th position. The word "ENTER " and PMORGN are copied into PMES, and UNITNM is inserted

into UNITPT if applicable. This is why UNITNM must be 12 characters long. If PMORGN is longer than 58 characters, the prompting message will be two lines long. The string "ENTER" is printed immediately and PMORGN alone is copied into PMES, corrected by UNITNM if necessary. PMES will be the second line of the prompting message.

When the dialogue is terse, PMES is created from the word "ENTER ", followed by DBNAME, UNITPT adjusted by UNITNM, and lastly a trim character.

If the message preparation is successful, RVAPMP is set to .TRUE. and control returns to RSCLDR or RA1LDR as applicable. If, however, an error occurs, VITAL is checked. The user is advised that the variable is essential when VITAL=.TRUE.. If ALLFLG also is .TRUE., it is changed to .FALSE. and the user told the "all" option is no longer in effect. In all cases of error, RVAPMP is returned as .FALSE. to the calling program. When successful, RVAPMP is set to .TRUE. before returning control.

4.3.4 RSREAD

4.3.4.1 Calling sequence. Logical function RSREAD reads the real scalar sought from one of the four valid sources of information. It includes 13 parameters in its calling sequence, almost all of which are identical to those in RSCLDR. The sequence is listed here:

```
LOGICAL FUNCTION RSREAD(RVAR,ALLFLG
                        MTERSE,IOMODE,NCPW,DBNAME,
                        UNITFM,UNITFA,
                        VITAL,PMES,RNFILE,FORMAT,DEFALT)
```

Note the absence of UNITNM, PMPREP and PMORGN. These variables have either been used or incorporated into PMES, which is defined at this point.

4.3.4.2 Characteristics. If the source of information is indicated to be the user hoping to input x-y coordinates from the screen, he is informed that this mode of input is inappropriate for real scalar input. The usual checks of VITAL and ALLFLG and messages occur.

The DEX routine RGET is used to read the real scalar from the database and it returns error codes for either success or the problems which can occur. The latter are brought to the user's attention. DEX routine REALIN (reference [5]) is used to read the real scalar from the terminal.

In cases where an error occurs, the user is informed if the variable is essential for input continuation. When VITAL and ALLFLG are both .TRUE., ALLFLG is set to .FALSE. and the user is informed. Further, if IOMODE=1 but there is no open database, or IOMODE=4 but a premature end-of-file is encountered, ALLFLG is set to .FALSE. regardless of the value of VITAL.

RSREAD is set to .TRUE. if successful and .FALSE. if an error occurs, and control is then returned to the calling program. When successful, prior to returning control, the value read is converted into program standard units by the expression

RVAL=RVAL * UNITFM + UNITFA

4.4 Real Array Series

4.4.1 Brief description. The real array reading routines include RA1LDR and RA1RED, plus RVAPMP which is shared with the real scalar series. Their function is to read one dimension real arrays, up to the current DEX limit of 200 elements, from any of the four valid sources of input. The reading of x-y coordinates from the screen, while legitimate for an array since it can store a pair of real numbers, has not been implemented yet and the user is advised of this. The next generation of DEX at MIT will include routines for reading and writing two arrays simultaneously for graphics tasks.

4.4.2 RA1LDR.

4.4.2.1 Calling sequence. Logical function RA1LDR invokes RA1RED to read a real array from the designated source. It also calls RVAPMP as necessary to prepare a prompting message for terminal input. Its calling sequence, listed here, has a few parameters not seen in RSCLDR:

```
LOGICAL FUNCTION RA1LDR(R1ARR,ALLFLG,NGOT,
                        MTERSE,IOMODE,NCPW,DBNAME,
                        MXTOGT,UNITFM,UNITFA,UNITNM,
                        VITAL
                        PMPREP,PMES,PMORGN,RNFILE,FORMAT,
                        NDEF,DEFALT)
```

R1ARR is the real array that will store the elements, in program standard units, that are read. MXTOGT represents the maximum number of elements to be read into R1ARR, and is the dimensioned size of R1ARR. NGOT is the number of elements actually read and can be less than or equal to MXTOGT. NGOT need not be defined when RA1LDR is invoked. NDEF is the number of default values and is provided to allow the default condition to be smaller than the maximum capability of the array.

4.4.2.2 Characteristics. When IOMODE=2 and PMPREP=.TRUE., RA1LDR invokes RVAPMP to prepare PMES. When RVAPMP is successful, and for the other valid sources of input (IOMODE=1, 4 or 5), RA1LDR calls RA1RED. If either RVAPMP or RA1RED are not successful, RA1LDR is set equal to .FALSE.. This also occurs when IOMODE=3. It is set to .TRUE. otherwise and control is returned to the calling program.

4.4.3 RA1RED

4.4.3.1 Calling sequence. The calling sequence for RA1RED is as follows:

```
LOGICAL FUNCTION RA1RED(R1ARR,ALLFLG,NGOT
                        MTERSE,IOMODE,NCPW,DBNAME,MXTOGT,
                        UNITFM,UNITFA,VITAL,
                        PMES,RNFILE,FORMAT,NDEF,DEFALT)
```

Like in RSREAD, UNITNM, PMPREP and PMORGN are no longer required. MXTOGT represents the maximum number of elements to be read into R1ARR, always starting at position 1. NGOT is defined in RA1RED.

4.4.3.2 Characteristics. RA1RED first employs DEX routine CHKRNG to verify that MXTOGT is not greater than the maximum DEX array size (currently 200 elements).

If IOMODE=3, the real array is not read and the appropriate checks of VITAL and ALLFLG and message issuing occur.

The reading of an array from a database is accomplished by DEX routine AGET, which seeks MXTOGT elements from the database array. AGET returns six possible result codes. RCODE=0 is simple success, that is, there were MXTOGT elements stored in the database array. NGOT is set equal to MXTOGT. If RCODE=1, there was no open database. This causes ALLFLG to change to .FALSE. if it was .TRUE. and RA1RED to be set to .FALSE.. RA1RED is also set to .FALSE. if the variable does not exist in the database (RCODE=2), if it is not an array (RCODE=3), of if it was undefined (RCODE=4). When the number of

elements requested exceeds the number stored (RCODE=5), the extra elements in R1ARR are set equal to 0.0 but NGOT is set equal to the number stored. When the number of elements requested is less than the number of elements stored (RCODE=6), the first MXTOGT elements are read into R1ARR and NGOT is set equal to MXTOGT. The user is advised in these circumstances of what has occurred.

When reading from the terminal, DEX logical function REALIN is invoked with the following statement:

LOGVAL = REALIN (MXTOGT,NEED,R1ARR,PMES)

A prompting message asks the user to input up to MXTOGT values. NEED represents the difference between the number of elements read in and MXTOGT. If no elements are read (NEED=MXTOGT) the reading is considered a failure. The reading is considered successful if at least one number is entered. NGOT is set equal to the number of elements entered.

The user is advised if a premature end-of-file is encountered when reading from a file.

When failures occur, VITAL and ALLFLG are processed as usual. Then RA1RED is set to .FALSE. and control returns to the calling program. If the reading is successful, the elements are converted into program

standard units by a DŌ loop for NGOT iterations with the statement

R1ARR(I) = R1ARR(I)*UNITFM + UNITFA

Then RA1RED is set to .TRUE. and control returns to the calling program.

CHAPTER 5

THE EXTENDED DEX LIBRARY EDITING ROUTINES

5.1 General Description

At some point in the operation of a program the user may decide that he wants to change the value of one or many variables. It may be that the value read as input is incorrect, or he wants to see the effect of changing one variable on the output. He may even decide he does not like the answer given by his program and, before storing it in a database or file, wishes to exchange it for another value he has. For whatever reason, the user requires the capability to enter the new value at the terminal. The editing routines were developed for this purpose.

Currently there are two logical functions in this category, ISCEDT and RSCEDT, with a third RAREDT, scheduled to be developed for the next version of the extended DEX library. ISCEDT allows the editing of integer scalar variables, RSCEDT allows the editing of real scalars, and RAREDT will allow the changing of elements in a real array.

5.2 Logical Function ISCEDT

5.2.1 Calling sequence. Logical function ISCEDT would be invoked by a module subprogram, normally when IOFLAG is set equal to 2 in a subroutine like MAINPG described in Chapter 2. The calling sequence includes 15 parameters listed here:

```
   LOGIAL FUNCTION ISCEDT(NEWVAR,ALLFLG,
                          MTERSE,NCPW,DBNAME,
                          MENUFL,MENUNM,NITEMS,ITEMS,
                          PMPREP,PMES,PMORGN,RNFILE,
                          FORMAT,DEFALT)
```

For ISCEDT, the first parameter is an output variable, ALLFLG is both input and output, and the remainder are all input variables.

NEWVAR will store the new value of the integer variable being changed. ALLFLG indicates the status of the calling program "all" option. Its value may be changed from .TRUE. to .FALSE. during the editing sequence.

Logical variable MTERSE indicates the type of module dialogue: terse or verbose. NCPW represents the number of characters per word assumed by DEX routines, and is dependent upon the particular computer in use DBNAME is the 8-character database name of the integer sought.

When MENUFL=.TRUE., the integer being sought is a menu selection. The eight-character menu name is stored

in MENUNM. NITEMS is the number of menu items, and it cannot exceed 12. ITEMS is where the menu choices are stored. Each item is described by an eight-character name (including blanks), so that, at four characters per word, ITEMS should be dimensioned as 2*NITEMS.

Since the new integer value will be entered at the terminal, a prompting message is required. PMPREP is a logical variable which indicates if the program is to prepare the message (.TRUE.) or if it is supplied by the calling program (.FALSE.). PMES is where the prompting message is stored. It can be up to 64 characters long, and if less it must include the trim character, "<", at its end. If PMPREP=.TRUE., PMES is undefined in ISCEDT.

PMORGN stores the information describing the variable in question. It is typically the database comment. PMORGN can be up to 64 characters long and requires the trim character if less. Because PMORGN is used to prepare the prompting message when the dialogue is verbose, if PMPREP=.FALSE., it need not be defined in ISCEDT.

RNFILE is the reference number for reading from a sequential file using Fortran READ and corresponds to RNRFIL in the calling program. FORMAT stores the format for reading from a file. DEFALT is the default value of the integer in question.

5.2.2 <u>Operation</u>. The task of ISCEDT is actually quite simple. In order to read a new integer from the terminal, ISCEDT merely invokes ISCLDR, using the variable EDMODE, which has a value of 2, in place of IMODE. ISCLDR then prepares a prompting message, if necessary, and calls ISREAD to read the value entered, ISCEDT is set to the same value with which ISCLDR is returned (i.e., .TRUE. for success), and control returns to the calling program.

In calling ISCLDR, ISCEDT defines the parameter VITAL as .TRUE. in all cases. This stems from the policy that if the user wishes to correct a value, he really wants to correct it for program continuation. Failure of any of the integer reading routines would change ALLFLG if it was .TRUE. when ISCEDT was invoked.

It may not be readily apparent to the reader, but because the source will always be defined as the terminal by ISCEDT, the calling parameters RNFILE, FORMAT and DEFALT, used only when IMODE=4 or 5, need not be defined here. In fact, dummy variables could have been used. It was decided to use the correct variables in the calling sequence to avoid potential errors by creating more variables. The ones used should already be available in the module, being needed for reading and writing integer values.

5.3 Logical Function RSCEDT

5.3.1 Calling parameters. Logical function RSCEDT is invoked by the module to permit the editing of a real scalar variable. Its calling sequence is as follows:

```
LOGICAL FUNCTION RSCEDT(NEWVAR,ALLFLG,
                        MTERSE,NCPW,DBNAME,
                        UNITFM,UNITFA,UNITNM,
                        PMPREP,PMES,PMORGN,RNFILE,
                        FORMAT,DEFALT)
```

All of the parameters except NEWVAR are input variables, and ALLFLG is both an input and output variable.

Most of these parameters are identical to those used in ISCEDT. Three are new. UNITFM and UNITFA are respectively the multiplicative and additive conversion factors for converting the real scalar read in user i/o units to the value NEWVAR in program standard units. UNITNM is a 12-character version (including blanks) of the user input/output units of the variable, and is used in preparing the prompting message when PMPREP=.TRUE..

5.3.2 Operation. RSCEDT behaves very similarly to ISCEDT. It calls RSCLDR with the variable EDMODE, defined as 2, in lieu of IMODE (terminal source) and VITAL specified as .TRUE.. The real scalar reading routines accept a value entered at the terminal, convert it to program standard units and store it in NEWVAR. If a failure occurs, ALLFLG changes to .FALSE. if it was .TRUE. when RSCEDT was invoked.

RSCEDT is set to the same value as RSCLDR (.TRUE. if NEWVAR is successfully read in, .FALSE. if an error occurred in the reading sequence) and control is returned to the calling program.

One can see that the editing routines are essentially another version of the reading routines. Current plans for the array editor anticipate extending this capability to include reorganizing the entries and inserting new values for whichever element or group of elements is specified by the user. Further, it is hoped that throught the editor, it will be possible to execute the calculation subprograms only for those elements changed in order to reduce computing costs. It may be that these options will be operated by the user by means of editing menus also. In short, the goal will be to simulate the editor capability of an interactive system such as CMS at MIT.

CHAPTER 6

THE EXTENDED DEX LIBRARY WRITING ROUTINES

6.1 General Description

Once information has been read, edited or computed, unless it is to be used as input for computations, it is necessary to transmit it to one of three possible destinations: a DEX-created database, the terminal or a sequential file. Further, for our purposes, a distinction shall be made between writing alphanumeric characters on the terminal screen via DEX routines and plotting the information on the screen as a graph. In the current version of DEX at MIT the plotting option is not yet implemented.

The function of the extended DEX library writing routines, described in this chapter, is to permit the transmission of the information to the three valid destinations. Eight logical functions comprise this group of routines, and, like the reading routines, they can be categorized by either type of variable handled or by function. They are listed here by the first method:

Integer Scalar	Real Scalar	Real Array
ISCDMP	RSCDMP	RARDMP
ISDSCR	RVDSCR	
ISRITE	RSRITE	RARITE

Both the real scalar and real array series share RVDSCR.

The top routines, called the "dumpers", serve a function similar to that of the loaders of the reading routines. They screen out requests to perform plotting, call the "descripters", if necessary, to prepare description messages for identifying the values when writing on the terminal, and invoke the "writers" to do the actual writing to the destination.

One general observation concerning the writing routines which is best made here is that the concept of "essential" variables, which was introduced in the chapter on the reading routines, is not employed. This affects the execution of a calling program all option. The premise is that when writing all the values from a menu, the failure to write one should not prevent the writing of the remainder. The user can go back and analyze why the one was not successful without having to rewrite all of the variables from the menu. The only case where the all option is aborted is where the destination is a database and no database is found open. Rather than getting a string of similar messages announcing this fact, the writing sequence is halted.

6.2 Integer Scalar Series

6.2.1 ISCDMP

6.2.1.1 Calling sequence. Logical function ISCDMP is the supervisory subroutine for writing integer scalar values and is the subroutine which appears in module subprograms. The calling sequence contains eleven parameters and is listed here:

```
LOGICAL FUNCTION ISCDMP(ALLFLG,MTERSE,IOMODE,NCPW,
                        IVAR,DBNAME,DMORGN,
                        DMPREP,DMES,RNFILE,FORMAT)
```

In accordance with DEX practices, the output variables come first in the calling sequence. ALLFLG is both an input and output variable for ISCDMP, being defined at the invocation and capable of having a different value when ISCDMP is returned to the module subprogram. ALLFLG contains the information about the calling program all option.

The remaining parameters are exclusively input variables from the point of view of ISCDMP. MTERSE indicates the type of module dialogue. NCAW is the number of characters per word assumed by the DEX routines. IOMODE corresponds to OMODE in the module calling program and represents the destination of the information to be written. As a reminder, its values are repeated here:

IOMODE=1: a DEX-created database

IOMODE=2: the terminal using DEX routines

IOMODE=3: the screen using plotting routines

IOMODE=4: a sequential file using a formatted WRITE statement

IVAR is the integer value which is to be written. DBNAME is the 8-character database name of the variable. DMORGN is a string of up to 64 characters which describes the variables. It is usually the database comment. If it has less than 64 characters it must include the trim character "<". The routines in this series assume that integer variables have no units.

DMPREP is a logical variable which, if .TRUE., means that the description message is to be prepared by ISDSCR. In this case, DMES is undefined. DMES is where the description message is stored. If the dialogue is verbose it can-be up to 64 characters by, whereas if the dialogue is terse it will only contain DBNAME. If DBPREP=.FALSE., DMES must be provided by the module and must include the trim character if it is less than 64 characters long.

RNFILE is the file reference number for writing to a sequential file. It corresponds to RNWFIL in the calling program. FORMAT contains the format to be used to write the integer available to the file.

6.2.1.2 Characteristics. ISCDMP first checks the destination pointer. If IOMODE=3, the user is informed that plotting is an improper mode of output for an integer scalar value and ISCDMP is set to .FALSE. before returning control to the calling program.

If IOMODE=2 and DMPREP=.TRUE., ISCDMP calls ISDSCR to prepare the description message for identifying the integer when it is written to the terminal. When this is successfully accomplished, or when IOMODE=1 or 4, ISCDMP invokes ISRITE to actually perform the writing.

If either ISDSCR or ISRITE is returned .FALSE., ISCDMP is also set to .FALSE. and control is returned to the calling program. Otherwise, it is set to .TRUE. prior to returning control.

When invoking ISRITE, a new logical variable, DBCHNG, is introduced. It is included in anticipation of future capabilities of DEX and indicates when a change is made to a database value. This will alert the user to check other variables which are dependent on the value of the integer being written. Currently DBCHNG is initialized as .FALSE. in ISCDMP.

6.2.2 ISDSCR

6.2.2.1 Calling sequence. Logical function ISDSCR prepares a description message suitable for

identifying the integer available when it is to be written on the terminal. Its calling sequence lists the pertinent parameters provided by ISCDMP:

```
LOGICAL FUNCTION ISDSCR(DMES,MTERSE,NCPW,DBNAME,DMORGN)
```

The value of logical variable MTERSE dictates whether the description message, to be stored in DMES, will be brief or long. NCPW is used by the DEX routines which manipulate character strings to produce the message.

6.2.2.2 <u>Characteristics</u>. If the dialogue is verbose, DMORGN, which contains a string of up to 64 characters describing the integer variable in question, is inserted into DMES. For terse dialogue, DBNAME is copied into the description message. If the insertion is successful, ISDSCR is set to .TRUE. and control returns to ISCDMP. If not, an error message is issued and ISDSCR is returned .FALSE..

6.2.3 <u>ISRITE</u>

6.2.31. <u>Calling sequence</u>. Logical function ISRITE actually writes the integer available to the specified destination. Its calling sequence is as follows:

```
LOGICAL FUNCTION ISRITE(ALLFLG,DBCHNG,MTERSE,IOMODE,
                        NCPW,
                        IVAR,DBNAME,DMORGN,DMES,RNFILE,
                        FORMAT)
```

Logical variables ALLFLG and DBCHNG are defined when ISRITE is invoked. DBCHNG is always .FALSE., and will become .TRUE. if a change is made to the integer variable DBNAME in the database. DMES is always defined when ISRITE is invoked so DMPREP is no longer needed. DMORGN is required because it may be used for comparison with the database comment.

6.2.3.2 Characteristics. If the destination of the integer available is a database, ISRITE first attempts to extract an existing value by DEX routine IGET (reference [5]). If no database is open, ALLFLG is changed to .FALSE. if it was not already, with an appropriate message being issued to the user. If the variable is defined in the database, and it is different from the integer available, both are presented for the user's inspection. The user then specifies which is to be placed in the database. The new value is inserted by DEX routine IPUT (Reference [5]) and DBCHNG becomes .TRUE.. If the variable was not defined, the new value is automatically inserted. Once this is accomplished, the database comment is compared to DMORGN and, if different, they are presented for the user's inspection. Again, he specifies which is to be the final database comment.

When writing to the terminal, an output message is created from DMES, the string " = " and the integer value. The entire message is then printed by DEX routine MESOUT.

If IOMODE=3, the user is informed that plotting is an improper mode of output for an integer scalar. In this case, and other cases where the writing is unsuccessful, ISRITE is returned .FALSE. to the calling program. Otherwise it is set to .TRUE. prior to returning control.

6.3 Real Scalar Series

6.3.1 RSCDMP

6.3.1.1 Calling Sequence. RSCDMP is the subprogram that normally appears in the module for writing a real scalar value to the designated source. Its calling sequence includes 14 parameters:

```
LOGICAL FUNCTION RSCDMP(ALLFLG,MTERSE,IOMODE,NCPW,
                        RVAR,DBNAME,UNITFM,UNITFA,
                        UNITNM,
                        DMPREP,DMES,DMORGN,RNFIL,
                        FORMAT)
```

All of these parameters are input variables with respect to RSCDMP except ALLFLG, whose value may be changed during the writing sequence. RVAR stores the value of the real scalar available to be written. UNITFM and UNITFA are respectively the multiplicative and additive

conversion factors for converting the real value in program standard units to input/output units prior to the writing. UNITNM is a 12-character version (including blanks) of the input/output unit name. DMPREP indicates if the description message, DMES, is to be prepared by RVDSCR.

DBNAME is an 8-character name of the real scalar and DMORGN is a string of up to 64 characters which identifies the variable. If the variable is dimensioned, DMORGN contains the string "(????????????)", referred to as UNITPT, into which UNITNM will be inserted. DMORGN must include the trim character if it is less than 64 characters long. RNFILE, corresponding to RNWFIL of the module calling program, is the file writing device number. FORMAT contains the format for writing to a file with a formatting Fortram WRITE statement.

6.3.1.2 <u>Characteristics</u>. RSCDMP has three tasks: to screen out requests to plot a real scalar, to call RVDSCR if DMPREP=.TRUE. and IOMODE=2, and to call RSRITE to perform the actual writing. If IOMODE=3, RSCDMP issues a message informing the user that this is not possible. In this case, of if either RSDSCR or RSRITE are returned .FALSE., RSCDMP is set to .FALSE. and control is returned to the calling program. If the called

functions are returned .TRUE., RSCDMP is also set to .TRUE. before returning control to the calling program.

In invoking logical function RSRITE, the logical variable DBCHNG is introduced. It is initialized in RSCDMP as .FALSE.. If, when executing RSRITE the variable value is changed in the database, DBCHNG is returned to RSCDMP as .TRUE.. In future versions of DEX, RSCDMP will pass the value of DBCHNG back to the calling program to alert the user to check other variables which are dependent on RVAR.

6.3.2 RVDSCR

6.3.2.1 Calling sequence. In the same manner as RVAPMP, RVDSCR is shared by both the real scalar and real array series. Its function is to prepare a description message suitable for identifying the values being written on the terminal. It is invoked by either RSCDMP or RARDMP using the following calling sequence:

```
 LOGICAL FUNCTION RVDSCR(DMES,MTERSE,NCPW,DBNAME,
                         DMORGN,UNITNM)
```

DMES is undefined when RVDSCR is invoked. The other parameters are all input variables from this function's point of view. They have all been described in either section 6.2.1.1 or 6.3.1.1.

6.3.2.2 Characteristics. If the module dialogue is verbose (MTERSE=.FALSE.), the description message is formed by copying DMORGN into DMES. If the real scalar being written has units, RVDSCR inserts the 12-character unit name UNITNM into the string UNITPT, "(????????????)", which is now in DMES by virtue of having been in DMORGN. If the dialogue is terse, then RVDSCR copies DBNAME into DMES. It then scans DMORGN for UNITPT, and if it finds it, copies UNITPT into DMES following DBNAME and replaces the question marks with UNITNM. If DMES is successfully prepared, RVDSCR is returned .TRUE.. Otherwise it issues an error message, is set to .FALSE., and returns control to the calling program (either RSCDMP or RARDMP).

6.3.3 RSRITE

6.3.3.1 Calling sequence. Logical function RSRITE is used to write a real scalar to the valid specified destination. Its calling sequence is as follows:

```
LOGICAL FUNCTION RSRITE(ALLFLG,DBCHNG,MTERSE,IOMODE,NCPW,
                        RVAR,DBNAME,UNITFM,UNITFA,UNITNM,
                        DMORGN,DMES,RNFILE,FORMAT)
```

This is similar to RSCDMP with three exceptions. DBCHNG is a logical variable which is always .FALSE. when RSRITE is invoked. DMPREP is no longer needed since in all

cases DMES is now defined. DMORGN is still requried because it will be compared with the database comment.

6.3.3.2 Characteristics. RSRITE first converts the real scalar value from program standard units to user input/output units, stored in variable TVAR, by the statment:

TVAR = (RVAR-UNITFA)/UNITFM

If IOMODE=1, the database is first checked to see if a value in question already exists. If the database is found closed, RSRITE alerts the user and changes ALLFLG to .FALSE. if it was not already so. If the variable does not exist in the database, it is inserted using DBNAME, TVAR and DMORGN (corrected for units if applicable) as its name, value and database comment. If the variable exists but is not a real scalar, RSRITE informs the user and is set to .FALSE..

If the variable exists and is defined, its value is compared to TVAR and the user is presented with both if there is a difference. He then is asked which value he wants in the database and the chosen one is written (or left) in. RSRITE then compares the existing database comment to the one specified by DMORGN and writes them both for the user's inspection if they are different. The user then specifies which one is to be the

database comment. This step is crucial in insuring that the correct units for TVAR exist in the database comment.

When writing to the terminal, an output message is constructed using DMES, the string " = " and the real value. This message is then printed by DEX routine MESOUT.

If IOMODE=3 despite the previous checks, the user is informed that a plot cannot be used for writing a real scalar value, and RSRITE is returned .FALSE. . RSRITE is set to .FALSE. in all cases where the real value is not successfully written and control is then returned to the calling program. Otherwise it is returned .TRUE. to RSCDMP.

6.4 Real Array Series

6.4.1 RARDMP

6.4.1.1 Calling sequence. Logical function RARDMP is used in the module subprogram for writing a real array. It has the same three functions as RSCDMP and ISCDMP: to screen out requests to plot graphs, to call RVDSCR if needed to prepare a description message, and to call RARITE to actually do the writing. It has the following calling sequence:

```
LOGICAL FUNCTION RARDMP(ALLFLG,MTERSE,IOMODE,NCPW,
                        R1ARR,DBNAME,NFROM,NTO,
                        UNITFM,UNITFA,
                        UNITNM,DMPREP,DMES,DMORGN,
                        RNFILE,FORMAT)
```

A few new parameters deserve explanation. R1ARR stores the array elements, in program standard units if they have dimensions. The array corresponding to R1ARR in the module should be dimensioned as large as the value MXTOGT used in RA1LDR for reading the array.

NFROM represents the position in the array at which writing commences. It should always have a value of 1, specified in the module calling program, except possibly when writing to the terminal. If the user is in the "editing" versus the "writing" mode of operation, he may desire to write only part of an array on the terminal. In this case the editing routine specifies NFROM to be a value from 1 to NTO inclusive prior to invoking RARDMP. NFROM should be 1 when writing the array on the terminal when not in the "editing" mode.

NOT represents the number of elements to be written in all cases but one. This exception occurs when writing to the terminal in "editing" mode, when NTO indicates the last element in the array to be written. Other than this case, NTO corresponds to the value NGOT obtained when reading the array with the reading routines (i.e.,

the actual number of elements read into the array represented by R1ARR), and may be less than MXTOGT.

The other parameters in the calling sequence are the same as those in RSCDMP.

6.4.1.2 Characteristics. If IOMODE=2 and DMPREP=.TRUE., RARDMP invokes RVDSCR to prepare a description message suitable for identifying the array being written to the terminal. If RVDSCR is successful, and for IOMODE=1 and 4, RARDMP invokes RARITE with the statement

```
LOGVAL=RARITE(ALLFLG,DBCHNG,MTERSE,IOMODE,NCPW,
              R1ARR,DBNAME,NFROM,NTO,UNITFM,UNITFA,
              UNITNM,
              DMORGN,DMES,RNFILE,FORMAT)
```

In this version of DEX, DBCHNG is initialized .FALSE. in RARDMP. If a change is made to a database array by RARITE it will be changed to .TRUE.. In future versions RARDMP will pass the value of DBCHNG back to the user via its calling sequence, to alert the user who may wish to verify other variables dependent upon this array.

If IOMODE=3, RARDMP informs the user that it cannot be used to write a real array. In this case, or if RVDSCR or RARITE is returned .FALSE., RARDMP is set to .FALSE. prior to returning control to the calling program. If the two called functions are successful, RARAMP is also set to .TRUE..

6.4.2 <u>RARITE</u>. Since the calling sequence for RARITE has been described above, this section will only discuss RARITE's characteristics. The task of this logical function is to write the real array elements available to the proper specified destination. The first action it takes is to convert the elements in program standard units to input/output units and store them in a temporary array. This is done with a DO loop from NFROM to NTO and the statement

RTARR(I) = (R1ARR(I)-UNITFA)/UNITFM

The elements in RTARR are in the units described by UNITNM.

If the destination is a database (IOMODE=1), it is desired to compare the existing array with the new one. RARITE first attempts to extract the existing array and store it in a working array RXARR using DEX routine AGET by the calling sequence

LOGVAL=AGET(DBNAME,RXARR,NTO,NSTORD,RCODE)

There are six possible result codes returned by AGET. If RCODE=Ø, AGET was completely successful in that the number of elements stored in the database array (NSTORD) is equal to the number requested (NTO), which is also the number of new elements to be stored. If RCODE=1, the database was not open. This will cause ALLFLG to change to .FALSE. if it was not already, aborting the calling program all option.

If DBNAME does not exist in the database (RCODE=2), it is created with DEX function DBVINS, and RTARR is stored in it. RTARR is also immediately stored if the array DBNAME exists but has no datum stored in it (RCODE=4). If DBNAME is not a real array (RCODE=3), the user is informed.

The final two result codes are more diabolical. If the number of elements stored in the database array is less than the number requested by AGET (RCODE=5), the elements that do exist, plus zeros up to NTO elements, are stored in RXARR. The user is advised that this has occured, that comparison of the existing values in RXARR and the new values in RTARR can be accomplished, but that the new values cannot be stored if the user decides they are the ones desired. This is because the storing of an array is performed by DEX routine APUT via the statement

LOGVAL=APUT(DBNAME,RTARR,NTO,NSTORD,RCODE)

Unless NTO=NSTORD, the storing will not occur. All is not lost, however! The user can proceed back to the module calling program, exit to the DEX level via the "$" command and delete the array with the DEX editing capability. He can then return to the module and write the array into the database when AGET returns RCODE=2.

The other problem occurs when the number requested is less than the number stored (RCODE=6). In this case NTO elements are stored in RXARR for comparison, but for the same reason as above, the user is advised that storing the new values will not be possible.

Once RXARR is established (RCODE=0, 5 or 6), a comparison between its elements and those of RTARR is conducted. The criteria for difference is 1.0×10^{-6}. The user is informed of how many differences were found and asked if an inspection of all the values is desired. A partial review is not possible. If the user responds affirmatively, the values are listed. UNITNM is printed in the heading. RARITE then asks the user to specify which group of values (all old or all new) is desired. If the user chooses to insert the new values, DBCHNG is set to .TRUE. and APUT is called to store the values. Error messages will be issued if NTO does not equal NSTORD.

If the writing is successful, or if the old values are retained, RARITE proceeds to compare the database comment to DMORGN, corrected for units, if applicable. When not the same, it prints both and asks the user to decide which is correct, storing the one chosen as the database comment. If there was no comment already in the database, DMORGN is automatically inserted.

When the destination is the database, the writing is considered successful only when all the new values are successfully stored or the old values retained. All the other possibilities result in RARITE being returned to RARDMP as .FALSE..

If IOMODE=2, the description message, DMES, is printed on the terminal, and then the array is listed from position NFROM to NTO. If IOMODE=3, the user is informed that plotting the array cannot be accomplished and RARITE is set to .FALSE..

When IOMODE=4, the array is written to a sequential file by a DO loop from 1 to NTO with the statement

```
WRITE(RNFILE,FORMAT) NTO,(RTARR(I),I=1,NTO)
```

In the cases where the writing is successful RARITE is set to .TRUE. and control is returned to the calling program.

CHAPTER 7

THE EXTENDED DEX LIBRARY UNIT ROUTINES

7.1 General Description

The module author will invariably write the computational subprograms of the module in the unit system with which he is most familiar. Frequently, it is not the system that the user of the module prefers. The tenet of the DEX philosophy to make modules convenient to use dictated that this problem be addressed. The result was the development of a group of subprograms in the extended DEX library which allow the user to choose from a reasonable selection, the units for input and output purposes for five basic types of measurement, plane angle, force, length, temperature, and time - and combinations thereof.

The twenty-two extended DEX library unit routines can be divided into three categories:

(i) Five subroutines which enable the user to choose from the options available the preferred input/output (i/o) units.

(ii) Five logical functions which enable the module to obtain conversion factors which convert the five basic user-specified (i/o) units into the program standard units (p.s.u.) and to obtain the unit names of the i/o units for use in prompting and des-

cription messages on the terminal and database comments.

(iii) Twelve logical functions which enable the module to obtain the conversion factors and unit names or special names for combinations of the basic units.

This chapter will examine each category.

7.2 The I/O Unit Specifiers

7.2.1 General Description. The extended DEX library includes five subroutines which enable the user to read, edit, or write the five basic units he wishes to use for input and output. These are listed here:

```
AUNIT  (plane angle)
FUNIT  (force)
LUNIT  (length)
TPUNIT (temperature)
TUNIT  (time)
```

The user must choose from the units offered by the particular subroutine menu options. These choices were included in anticipation of the possible needs of most users. Table 7-1 lists the choices available.

7.2.2 Characteristics of a Typical Subroutine. In execution, the five subroutines simply call ISCLDR to read the input/output unit indicator, ISCEDT to edit the i/o unit indicator, or ISCDMP to write the i/o unit indicator. Because all five subroutines are structured identically, only one, AUNIT, will be described in detail.

Table 7-1. I/O Unit Specifier Subroutines, Menu Names and Units Available

	AUNIT	FUNIT	LUNIT	TPUNIT	TUNIT
	ANG.UNIT	FOR.UNIT	LEN.UNIT	TEMPUNIT	TIMEUNIT
1	cycle	poundal	inch	Celcius deg.	second
2	radian	poundforce	foot	Fahrenheit deg.	minute
3	degree (ang)	short ton	statute mile	Kelvin deg.	hour
4	minute (ang)	long ton	nautical mi.	Rankine deg.	week
5	second (ang)	dyne	millimeter		month (30 day)
6		newton	centimeter		year (360 day)
7		kilopond	meter		
8			kilometer		

Its calling sequence is listed here:

```
          SUBROUTINE AUNIT(UIOAUN,CALALL,IOFLAG,IOMODE,
                           MTERSE,DBAUNN,DBAUNC,PMPREP,
                           PMES,RNFILE,AUNFRM,DEFAUN)
```

The calling sequences for the others are similar. Table 7-2 lists the comparable distinctive parameters.

UIOAUN denotes the i/o angle unit and can be either an output variable (when reading or editing) or an input variable (when writing). It has the following integer values depending on the specific i/o angle unit:

1: cycle
2: radian
3: degree (angular)
4: minute (angular)
5: second (angular)

CALALL is a logical variable which indicates the status of the calling program "all" option. Recall from the Cube Module that subroutine MXUNIT was the calling program for this series. IOFLAG indicates whether the operation is reading, editing, or writing (IOFLAG = 1, 2, or 3 respectively) and dictates whether ISCLDR, ISCEDT or ISCDMP will be invoked. IOMODE indicates the source when reading and the destination when writing. MTERSE, NCPW, PMPREP, PMES, and RNFILE fulfill the same roles as described in previous chapters.

DBAUNN is where the database name of the angle unit, "UIOAUN", is stored. DBAUNC is a character

Table 7-2. I/O Unit Specifier Subroutine Calling Parameters

	Subroutine				
Parameter	AUNIT	FUNIT	LUNIT	TPUNIT	TUNIT
I/O Unit Indicator	UIOAUN	UIOFUN	UIOLUN	UIOTPU	UIOTUN
Database name	DBAUNN	DBFUNN	DBLUNN	DBTPUN	DBTUNN
Database comment	DBAUNC	DBFUNC	DBLUNC	DBTPUC	DBTUNC
File format	AUNFRM	FUNFRM	LUNFRM	TPUFRM	TUNFRM
Default variable	DEFAUN	DEFFUN	DEFLUN	DEFTPU	DEFTUN

Table 7-3. Basic Unit Series Calling Parameters

	Subroutine				
Parameter	AUNIT	FUNIT	LUNIT	TPUNIT	TUNIT
Conversion factor	CONVA	CONVF	CONVL	CNVTPM CNVTPA	CONVT
One letter abbrev.				NAMTP1	
Two letter abbrev.		NAMF02	NAML02		NAMT02
Three letter abbr.	NAMA03	NAMF03			NAMT03
Five letter abbrev.				NAMTP5	
Six letter abbrev.	NAMA06		NAML06		NAMT06
Eight letter abbr.	NAMA08				
Twelve letter abb.	NAMA12	NAMF12	NAML12	NMTP12	NAMT12
Program standard unit indicator	PSTAUN	PSTFUN	PSTLUN	PSTPUN	PSTTUN
I/O unit indicator	UIOAUN	UIOFUN	UIOLUN	UIOTPU	UIOTUN

string which identifies the angle unit variable. It is used as the database comment and in the preparation of the prompting and description messages. AUNFRM is the format to be used if the angle unit indicator is to be read from or written to a sequential file. DEFAUN is the default value of the angle unit indicator if that is chosen as the source.

In operation, AUNIT branches depending on the value of IOFLAG and calls ISCLDR, ISCEDT, and ISCDMP. When the user wishes to read the angle unit, AUNIT provides menu "ANG.UNIT" with its five choices to ISCLDR. This is an example of when a menu is used to input an integer value. The reader should understand that is is not the name of the unit which is read or written by these subroutines, but rather an integer value which denotes the i/o unit to be used.

7.3 The Basic Unit Series

7.3.1 Series Description. Since the module author knows and provides indicators for the units in which he has written his program, once the user specifies the units he wishes to use during input and output, it is possible to determine the conversion factors for relating the i/o units to the program

standard units. These conversion factors can then be passed on to the loaders when reading variables (real scalars or arrays) to convert their values in i/o units to p.s.u. for the module computing subprograms. Similarly, these factors can be passed on to the dumpers when writing variables to convert their values in p.s.u. to i/o units. The determination of the conversion factors for the five basic types of units is accomplished by five logical functions listed here:

```
UNITAF  (angle units)
UNITFF  (force units)
UNITLF  (length units)
UNITMP  (temperature units)
UNITTF  (time units)
```

These functions accomplish one other task: they prepare various alphabetic character versions of the input/output unit names, up to twelve characters long, which are used in database comments and prompting and description messages. This is explained further below.

7.3.2 Calling Parameters. Once again, because all five subroutines are essentially structured the same, only one, UNITFF, will be described in detail. The calling sequence for UNITFF, as it would appear in a module subprogram for reading, editing, or writing input/output variables, is as follows:

```
LOGVAL=UNITFF(CONVF,NAMFØ2,NAMFØ3,NAMF12,
```

ALLFLG,PSTFUN,UIOFUN,NCPW)

The sequence is similar for all five functions with two exceptions. The number of versions of the unit names for some is different and UNITMP includes two conversion factors instead of one. Table 7-3 lists the comparable calling parameters for the five functions.

The first four calling parameters are defined by UNITFF and the four are input variables to the function. CONVF is the multiplicative conversion factor which partially converts the force values from i/o units to p.s.u. when reading or editing and does the reverse when writing. The conversion also requires an additive conversion factor which, in all cases except with temperature units, is equal to zero and is provided to the loader, editor, or dumper by the module. The conversion that takes place in the reading routines is of the form:

VARIABLE(p.s.u.)=VARIABLE(i/o unit)*UNITFM+UNITFA

where UNITFM is the multiplicative conversion factor determined by one of these functions and UNITFA is the additive conversion factor.

NAMFØ2, NAMFØ3, and NAMF12 are respectively two-, three-, and twelve- character abbreviations of the

force unit used during input and output. NAMF12 is used as UNITNM in prompting and description messages and database comments for force variables (recall that UNITNM must be a twelve character version of the relevant unit). Tables B-1 through B-5 in Appendix B list the various abbreviations of the five basic units.

PSTFUN and UIOFUN denote the program standard force unit and the input/output force unit respectively. They can each be an integer between 1 and 7 inclusive, corresponding to the seven permissible force units listed in Table 7-1.

7.3.3 Execution. When invoked, UNITFF calls routine CHKRNG to verify that PSTFUN and UIOFUN are within the permissible range 1-7. UNITFF then uses the pair (PSTFUN, UIOFUN) as an index to a data table included within the function to locate the conversion factor appropriate for converting an input value in the i/o force unit denoted by UIOFUN to the program standard force unit denoted by PSTFUN.

UIOFUN is also used as an index to another data table in the function which contains the various abbreviations of the seven force units. UNITFF employs DEX routine LMOVEC to copy the characters from the data table into the strings NAMFØ2, NAMFØ3, and NAMF12.

If a failure occurs in defining either the force unit conversion factor or the unit name, the user is informed that the appropriate variable has not been defined, is essential for i/o continuation, and must be corrected before continuing. ALLFLG is changed to .FALSE. if it was .TRUE. and UNITFF is set to .FALSE.. If successful in accomplishing both tasks it is set to .TRUE..

7.4 Derived I/O Unit Series

7.4.1 Series Description.

The third series in the units category contains twelve logical functions for defining conversion factors and unit names for units of measurement formed by combining basic units. These are listed in Table 7-4.

In order to operate these functions, the module author must first have either specified or allowed the user to specify the basic i/o units which are building blocks for these derived unit functions. The module program must then have used the appropriate basic unit series function or functions to obtain the various multiplicative conversion factors and abbreviations. These are then used as calling parameters for the derived units in this series.

Table 7-4. Derived I/O Unit Series

Function	Type of Measurement	Units of Measurement
UAACC	angular acceleration	plane angle/$(\text{time})^2$
UACCEL	linear acceleration	length/$(\text{time})^2$
UAREA	area	$(\text{length})^2$
UFREQ	frequency	plane angle/time
UKVISC	kinematic viscosity	$(\text{length})^2$/time
UMASS	mass	force-$(\text{time})^2$/length
UMPOWR	mechanical power	force-length/time
UPRESS	pressure	force/$(\text{length})^2$
UPSPEC	power spectrum	$(\text{length})^2$-time
URHO	mass density	force-$(\text{time})^2$/$(\text{length})^4$
USPEED	speed	length/time
UVOL	volume	$(\text{length})^3$

There is considerably more diversity in the calling sequences of the twelve functions. Appendix B, Table B-6, lists them for reference. In these functions only multiplicative conversion factors are used to determine the combined conversion factors because none involve temperature units. It should, therefore, be easy to identify CONVA, CONVF, CONVL, and CONVT as the angular, force, length, and time multiplicative conversion factors. The abbreviations of the basic units used in the calling sequences were shown in Tables B-1 through B-5.

One of the functions, UPRESS, will be described in more detail as an example of how they operate.

7.4.2 UPRESS Calling Parameters. UPRESS allows its users to define the unit conversion factor and name for a variable that has the units of pressure (force/area). The calling sequence for UPRESS is as follows:

```
LOGICAL FUNCTION UPRESS(UFPRESS,UNPRESS,ALLFLG,
                        CONVF,CONVL,NAMFØ3,
                        NAMFØ2,NCPW)
```

The pressure conversion factor UFPRESS converts the input/output pressure unit to the program standard pressure unit by multiplication when reading or editing and converts the p.s. pressure unit to i/o pressure unit when writing by division. The unit name UNPRES

is used to identify the units of the variable in question for messages and the database comment. UNPRES is a twelve-character string (including blanks). ALLFLG indicates the calling program "all" option. NAMFØ3 is a three-character force unit abbreviation and NAMLØ2 is a two-character length unit abbreviation.

7.4.3 <u>UPRESS Operation</u>. UPRESS first defines the pressure unit conversion factor by the statement

UFPRES = CONVF/CONVL**2

In order to form the pressure unit name, UPRESS defines a twelve-character dummy name variable UXPRES printed here:

"_ _ _/_ _ * * 2 _ _ _"

UPRESS inserts, via DEX routine LMOVEC, NAMFØ3 into the first three blank spaces and NAMLØ2 into the fifth and sixth spaces. The three "words" (four characters per word) of UXPRES are then set equal to the three words of UNPRES. As an example, if the force unit was poundforce and the length unit was inches, the final version of UNPRES would be

"LBF/IN**2   "

If a failure occurs in preparing the unit name, a message advises the user and informs him that the problem must be corrected, because it is essential for input/

output continuation. If ALLFLG was .TRUE. it is set equal to .FALSE. and the user is informed that the "all" option is aborted. UPRESS is then set equal to .FALSE. If it is successful, UPRESS is set equal to .TRUE..

Certain combinations of basic units have special universally recognized names used to identity the measurement unit. Where possible, the logical functions provide these names rather than creating a name by its contituents, such as UNPRES was formed in the above example. Table 7-5 lists these special names.

Although there are only twelve types of measurements listed the derived unit series have more versatility than first meets the eye. They can be used for units that have different names but the same basic units. For example, UPRESS can be used for stress units as well as pressure. In addition, they can be used for units that have different basic units but the same format. An example is provided by UAACC and UACCEL, which could be used for any unit type requiring one basic unit in the numerator and a basic unit squared in the denominator. The module author must be careful to supply the correct special parameters in the function calling sequence in the module calling subprogram.

Table 7-5. Special Unit Names

Function	Special Name	Meaning	Occurence
UFREQ	hertz	cycle/second	UIOAUN=1 and UIOTUN=1
UKVISC	stoke	centimeter^2/second	UIOLUN=6 and UIOTUN=1
UMASS	slug	lbf-second^2/foot	UIOFUN=2 and UIOLUN=2 and UIOTUN=1
UMASS	kilogram	newton-sec^2/meter	UIOFUN=6 and UIOLUN=7 and UIOTUN=1
UMPOWR	watt	newton-meter/sec	UIOFUN=6 and UIOLUN=7 and UIOTUN=1
URHO	slug/ft^3	slug/foot^3	UIOFUN=2 and UIOLUN=2 and UIOTUN=1
URHO	kg/m^3	kilogram/meter^3	UIOFUN=6 and UIOLUN=7 and UIOTUN=1
USPEED	knot	naut. mi./hour	UIOLUN=4 and UIOTUN=3

CHAPTER 8

DEVELOPMENT OF A CRUISER-DESTROYER DATABANK AT M.I.T.

8.1 Considerations in Database Design

8.1.1 Function. When designing a database, the developer must not only consider for what immediate function it is intended, but must also try and anticipate other future demands and organize it accordingly. One solution to this problem, in a sense an avoidance of it, is to create very specialized databases containing information about only one aspect of the overall project involved. The project has a databank comprised of many databases. Physical limitations on the database size, such as the limit of 200 variables in a DEX-created database, suggest this practice. These smaller databases may be more efficient from the point of view of computer costs when it comes to manipulating them. However, the situation can arise where a computer program requires as input data from several different databases, entailing the time consuming effort of opening and closing them all. Only experience in using the databases can reveal the deficiencies in their design.

The function of the cruiser-destroyer databases developed and/or envisioned in the Department of Ocean

Engineering at MIT is to support the naval architect during the concept and preliminary design phases of a ship design. During these phases a variety of products are developed, including the overall vessel dimensions and hull definition, hydrostatic and Bonjean curves, weight and volume estimates, longitudinal weight distribution, propulsion and electrical powering requirements, transverse stability and floodable length checks and general arrangements. The tasks to produce several of these, notably the determination of ship dimensions, weight and volume estimates, powering requirements and transverse stability, can be accomplished with the aid of a computer synthesis model. The REED Model [6] used at MIT is an excellent example of this design tool, and it was the anticipated support of that model that strongly influenced the databases designed in this investigation. The naval architect who chooses to use a synthesis model must carefully determine his input if he desires to use the model efficiently. Being able to draw upon a supply of existing ship information is invaluable to this effort, and this was one of the reasons for developing the cruiser-destroyer databases.

An effective database is one that can be shared by many different engineers involved in the ship design

project, each of whom has a different task to perform. Data should be stored in a form that allows each one to extract the information required and use it directly without having to pass it through some form of interpretation process. An example is a table of offsets database. Ideally, it contains sufficient offsets properly organized such that each one of the programs for hydrostatics, Bonjean curves, cross curves of stability, floodable length, structures and seakeeping can directly access it and obtain the input required without having to go through a "black box" interface program.

The development of a comprehensive computer-aided ship design system that ensures such program/database design requires a "top down" approach to the problem, as described in reference [7]. One starts with the overall objective and works down through functional specifications to complete system design. If successfully accomplished, as a result of strict discipline during the process, no unnecessary capabilities need be developed along the way. One proceeds from each level to the next lower by answering the question of how to provide for the needs of the higher one. This contrasts directly with the traditional method of many individuals writing programs for their specific task, and only after-

wards determining if these programs can be integrated for some higher objective.

8.1.2 Types of Databases. Accepting the concept of a bank of databases to describe a ship, either existing or being designed, we can list the types which will be useful:

1. General description
2. Weights and centers of gravity
3. Longitudinal weight distribution
4. Volumes, areas, and centroids
5. Offsets
6. Equipment specifications and locations
7. Power-speed data
8. Seakeeping data
9. Internal arrangements
10. Topside arrangements

This list is similar to that of the computer-aided ship design system implemented in the Ship Department of the British Ministry of Defense [8].

Storing in a computer databank several of these databases for many classes of ship is extremely helpful as a research resource during the concept design of a new vessel. Taking this one step further, as described in reference [8], is to establish "base" ship databanks made up of all of the database types. If a new vessel is similar to one of these, a copy of the databank provides an excellent starting point to begin defining the new design and can save much redundant work. This is

predicated on the assumption that all the databases of a particular type for all ships are identical in structure and differ only in content. Such a practice is essential to the efficient use of the databanks.

8.2 Organization of the MIT Cruiser-Destroyer Databases

8.2.1 General Databases. During this investigation work was conducted to establish the first two types of databases listed in Section 8.1.2 for eleven classes of U.S. cruisers, destroyers, and frigates. These classes are as follows:

FF-1040	DD-931	CG-16
FF-1052	DD-963	CG-26
FFG-1	DDG-2	CG-47
FFG-7	DDG-40	

This section will describe the organization of the general databases and the next section will describe the weights and centers of gravity databases.

The general databases are so named because they provide a general and not-too-detailed description of the ship class which would be useful to a researcher seeking to determine first estimates for a new design. The information was gleaned from various sources in the open literature, and the respective weight and moment reports and booklets of general plans [9,10,11,12].

The database contains eight categories of variables.

These are:

1. Hull characteristics
2. Propulsion and powering
3. Transverse and directional stability
4. Weapons payload
5. Electronics, fire control, and sensors
6. Aviation capability
7. Complement
8. Gross mass properties

Appendix C is an example of a general database. The individual entries are what would appear if one issued the "dump" command from the DEX level with a particular database open. The order of the listing would not be as they appear here because of a "hashing" function built into the DEX which distributes entries to a database in the memory randomly in order to store them more efficently.

There are actually 78 variables, listed in Table 8-1 which constitute the eight categories. Each one has a number assigned on the left hand margin. These serve as a convenient indicator for the creation of Fortran names for the various variables associated with each element used in a DEX program. For example, in the module MACHWT described later in this chapter, the program names for the default value and comment statement for propulsion plant type (Item #20) are DEF2Ø and

TABLE 8.1

GENERAL SHIP CHARACTERISTICS DATABASE
FOR U.S. NAVY CRUISER-DESTROYERS

	NAME	TYPE	COMMENT	UNITS
			HULL CHARACTERISTICS	
1.	LOA	R	Length overall	feet
2.	LBP	R	Length between perpendiculars	feet
3.	BEAMDWL	R	Molded beam at design waterline	feet
4.	BEAMMAX	R	Maximum beam	feet
5.	T	R	Molded draft to keel	feet
6.	CP	R	Prismatic coefficient	
7.	CX	R	Midship coefficient	
8.	CB	R	Block coefficient	
9.	CWP	R	Waterplane coefficient	
10.	LCB	R	Longitudinal center of buoyancy as a fraction of LBP aft FP	
11.	LCF	R	Longitudinal center of flotation as fraction of LBP aft FP	
12.	DEPTH1Ø	R	Depth amidships at centerline	feet
13.	DRAFTSON	R	Draft of sonar dome	feet
14.	DISPMLD	R	Molded displacement	tons
15.	DISPTOT	R	Total displacement including appendages	tons
16.	WETSURF	R	Wetted surface	sq. feet
17.	FOCSL	I	Raised forecastle (Ø = no 1 = yes)	
18.				
19.				
			PROPULSION AND POWERING	
20.	PPTYP	I	Type of propulsion plant	Reed
21.	SHP	R	Total installed shaft horsepower	hp
22.	NSHAFT	I	Number of propeller shafts	
23.	NE	I	Number of engines	
24.	NB	I	Number of boilers	

TABLE 8.1 (cont'd)

	NAME	TYPE	COMMENT	UNITS
25.	VSUS	R	Maximum continuous sustained speed	knots
26.	VEND	R	Endurance speed	knots
27.	ENDUR	R	Endurance range	n. mi.
28.	PRPTYP	I	Type of propeller (1 = FP 2 = CRP)	
29.	DPROP	R	Propeller diameter	feet
30.	RPM	R	Propeller rpm at full power	rpm
31.	SSEPTYP	I	Type of primary ship service electrical plant	Reed
32.	NSSG	I	Number of primary ship service generators	
33.	KWSSER	R	Installed primary ship service generator capacity	kw
34.	EMETYP	A(2)	Type of secondary or emergency electrical plant	Reed
35.	NEMG	A(2)	Number of secondary or emergency generators of each type	
36.	KWEMER	R	Installed secondary or emergency generator capacity	kw
37.	KWPEMG	A(2)	Capacity per secondary or emergency generator	kw
38.				
39.				
40.				
			TRANSVERSE AND DIRECTIONAL STABILITY	
41.	GM	R	Metacentric height uncorrected	feet
42.	FSUFCOR	R	Free surface correction	feet
43.	CI	R	Waterplane moment of inertia coefficient	
44.	FINSTABL	I	Fin stabilizers installed (Ø = no 1 = yes)	
45.				
46.	NRUDDER	I	Number of rudders	
47.				
48.				
49.				
			WEAPONS PAYLOAD	
50.	TYPGUNS	A(3)	Type of guns	Reed
51.	NGUNS	A(3)	Number of guns of each type	
52.	TYPMSL	I	Type of missile launchers	Reed
53.	NMSL	I	Number of missile launchers	

TABLE 8.1 (cont'd)

	NAME	TYPE	COMMENT	UNITS
54.	TYPCIWS	I	Type of close-in weapon system	Reed
55.	NCIWS	I	Number of close-in weapon systems	
56.	TYPBPDMS	I	Type of basic point defense missile systsm	Reed
57.	NBPDMS	I	Number of basic point defense missile launchers	
58.	TYPTORPL	I	Type of torpedo launchers	Reed
59.	NTORPL	I	Number of torpedo launchers	
60.	TYPASWL	I	Type of ASW launchers	Reed
61.	NASWL	I	Number of ASW launchers	
62.				
63.				
64.				
65.				
			ELECTRONICS, FIRE CONTROL AND SENSORS	
66.	TYPSONAR	A(2)	Type of sonar systems	Reed
67.	TYPDOME	I	Type of sonar dome	Reed
68.	TYPSURAD	I	Type of surface search radar	Reed
69.	TYP3DAIR	I	Type of 3-D air search radar	Reed
70.	TYP2DAIR	I	Type of 2-D air search radar	Reed
71.	TYPGRAD	I	Type of gun fire control radars or directors	Reed
72.	NGRAD	I	Number of gun fire control radars or directors	
73.	TYPMRAD	I	Type of missile fire control radars or directors	Reed
74.	NMSLRAD	I	Number of missile fire control radars or directors	
75.	TYPFCSG	I	Type of gun fire control system	Reed
76.	TYPFCSM	I	Type of missile fire control system	Reed
77.	TYPASWFL	I	Type of ASW fire control system	Reed
78.	TYPTDS	I	Type of tactical data system	Reed
79.				
80.				

TABLE 8.1 (cont'd)

	NAME	TYPE	COMMENT	UNITS
			AVIATION CAPABILITY	
81.	TYPHELO	I	Type of helicopters carried	Reed
82.	NHELO	I	Number of helicopters carried	
83.	HIFR	I	Helicopter in-flight refueling capability (1=yes Ø=no)	
84.				
85.				
			COMPLEMENT (ACCOMMODATIONS)	
86.	NOFF	I	Number of ship's officers	
87.	NCPO	I	Number of chief petty officers in ship's crew	
88.	NCREW	I	Number of enlisted in ship's crew	
89.	NFLAGOFF	I	Number of officers on flag staff	
90.	NENLSTF	I	Number of enlisted on flag staff	
91.	NTROOPS	I	Number of troops	
92.				
			GROSS MASS PROPERTIES	
93.	TYPMATL	A(2)	Type of material for hull and superstructure respectively	Reed
94.	WEIGHT17	A(7)	Weights of weight groups 1-7 respectively	tons
95.	VCG17	A(7)	Vertical centers of gravity of weight groups 1-7 respectively	feet
96.	WTLOADS	R	Weight of Group 8 loads	tons
97.	VCGLOADS	R	Vertical center of gravity for Group 8 loads	feet
98.				
99.				
100.				

CMNT2Ø respectively.

In each category some space has been left for additional variables. Further, experience with the databases may indicate that some items are not needed and can be deleted.

An inspection of both Table 8-1 and Appendix C reveals that certain items referring to the types of plant or type of equipment have integer values where one would expect a name. The reason for this is because only three types of variables are allowed in the DEX: integer scalar, real scalar, and real array. Alpha-numeric words in the "value" part of a database entry are not allowed. A code of integer values was needed to solve this dilemma, and it was decided to adopt the pay-load shopping list of the REED model because of its comprehensiveness and its widespread use at MIT. Appendix D contains the payload list from reference [6], with some additional items included for this application.

The restriction on arrays that they contain only real values poses a minor problem because they sometimes contain information from the code which should be stored as an integer. It should be obvious to the user from the array name that an integer value is implied. Arrays are used in some not very obvious cases in order to

accommodate the most information. An explanation of the array variables should prove helpful.

TYPMATL has two entries to distinguish between the type of material for the hull and the type of material for the superstructure. The integer values are 1 for steel and 2 for aluminum.

The type of sonar carried (TYPSONAR) is an array because some ships have two systems installed: a bow or keel-mounted sonar, plus a towed array or variable depth sonar.

NGUNS and TYPGUNS are three element arrays to accommodate the most number of distinguishable gun mounts in any of the classes, which exists on the DD-931 class. Not only does this destroyer carry two calibers, 5" and 3", but the REED payload code allows the distinction between a 5" gun mounted on the main-deck (93) and a 5" gun mounted on the 01 level (94).

The emergency or secondary electrical plant includes three array variables: EMETYP, NEMG, and KWPEMG. The CG-26 class cruiser has both a gas turbine-driven and diesel-driven emergency generator. Therefore, the first entries of the three arrays describes the one and the second entries describe the other.

Unfortunately, a great amount of the data available

from the various sources for the general database was conflicting. Where such descrepancies occurred, this investigator made choices based upon the most original source, or the value upon which the most sources agreed. Whenever possible, the original ship equipment is listed in order to correspond to the weights and centers of gravity databases, whose information comes from the original class weight and moment reports.

Any value that was either classified or unavailable was left undefined.

8.2.2 Mass Properties Databases. The general databases include a gross mass properties category which includes two arrays, WEIGHT17 and VCG17. These contain respectively the overall weights and centers of gravity of weight groups 1 through 7. The weight groups conform to the U.S. Navy BSCI organization of ship weights. Although the BSCI system has been replaced by the SWBS (Ship Work Breakdown System) in recent years, it was used for the databases because only the FFG-7 class is sufficiently recent to have its weight and moment report organized with the new system. Further, the REED model is based on BSCI.

The gross mass properties are included in the general databases because they are more frequently used for

estimations than the individual weight items, and their inclusion may save the user from inspecting two different databases.

There are about 150 items comprising the eight weight groups of the BSCI system. Therefore, the combination of weight and center of gravity for each item exceeds the limit of 200 entries in a DEX database. Although the use of arrays offers an apparent solution to this problem, the idea was discarded after careful consideration for several reasons. First, if one wished to store the weight in long tons, the vertical center of gravity in feet above baseline and the longitudinal center of gravity in feet aft of the forward perpendicular or from amidships in a three element array, not only would it be difficult to identify the information in the 64 characters of the database comment, but only one of the two unit names could be stored there. Another possibility was to store all of the weights (or centers of gravity) for one weight group in an array. There would then be eight weight arrays, eight vcg arrays and eight lcg arrays, with the proper units in the database comment. The limit of 200 elements per array would not be a problem because the largest index in any weight group is 51. This was considered

unsatisfactory because it was not felt that the one database comment for the array was sufficient to identify the individual weight items and an extra index would have to be provided to the user. Further, an additional process would have to be developed for extracting the particular weight item out of the array, and avoiding the need to know where a value was stored in the database was one of the driving principles for developing DEX databases to begin with.

Instead, it was decided to create a weight database and a vertical center of gravity database, with each item listed separately. Appendix E illustrates the listing of each type. No need was felt by this investigator for a longitudinal center of gravity database for existing ships. The estimating of the transverse stability of a new ship design can be done effectively using data from existing ships because the vertical locations of most items is restricted to a reasonable degree by physical factors or proven arrangements. The REED model demonstrates that dependable parametric equations can be developed for estimating vertical centers of gravity. However, there is far more flexibility in both theory and practice for the longitudinal locations of many of the same items. Therefore, it is

more difficult to correlate into acceptably accurate parametric equations the information available on lcg's in existing ships. This does not preclude the need for a database containing the longitudinal weight distribution of a ship design in order to support longitudinal strength and seakeeping analyses. Nor does it preclude the use of a longitudinal center of gravity database for a new ship in order to support longitudinal stability (i.e. trim) analyses.

8.3 Independent and Dependent Variables

8.3.1 Concept. Databases can be both the source and destination of information. A particular program may read its input from a database, calculate values for other variables in the database, and write the new values into those entries. This would be disastrous if uncontrolled. When administering a ship design project that involves multiple uses of the same databases, the ship design manager must have a system whereby he can control changes to the databases that occur as the design progresses around the design spiral. Further, the system should allow all design team members to be alerted to changes which may affect them. It is planned in future versions of DEX to implement a system that supports the concept of independent and dependent

variables.

Certain variables will be defined by the user as independent variables which, either by fact or intention, can not be changed despite changes in other variables. The remaining variables in the program or database are dependent on the former or each other for their values. Each entry in a database will be provided with an index of those variables whose value would be affected by a change in its value. When causing a change to such an entry (i.e. DBCHNG becomes .TRUE.), the user can query this index to determine which other items should be checked.

This task is extremely difficult in ship design because of the interaction of almost all of the variables. Ship design is not a linear process but a spiraling one. Figure 8-1 illustrates an attempt to group the variables of the general database into five levels of dependence. The first column represents those variables which can be considered independent. These might appear as specifications in a Top Level Requirement or they might be the result of trade-off studies during the design phase.

The second group consists of those variables which are most directly affected by the independents or which

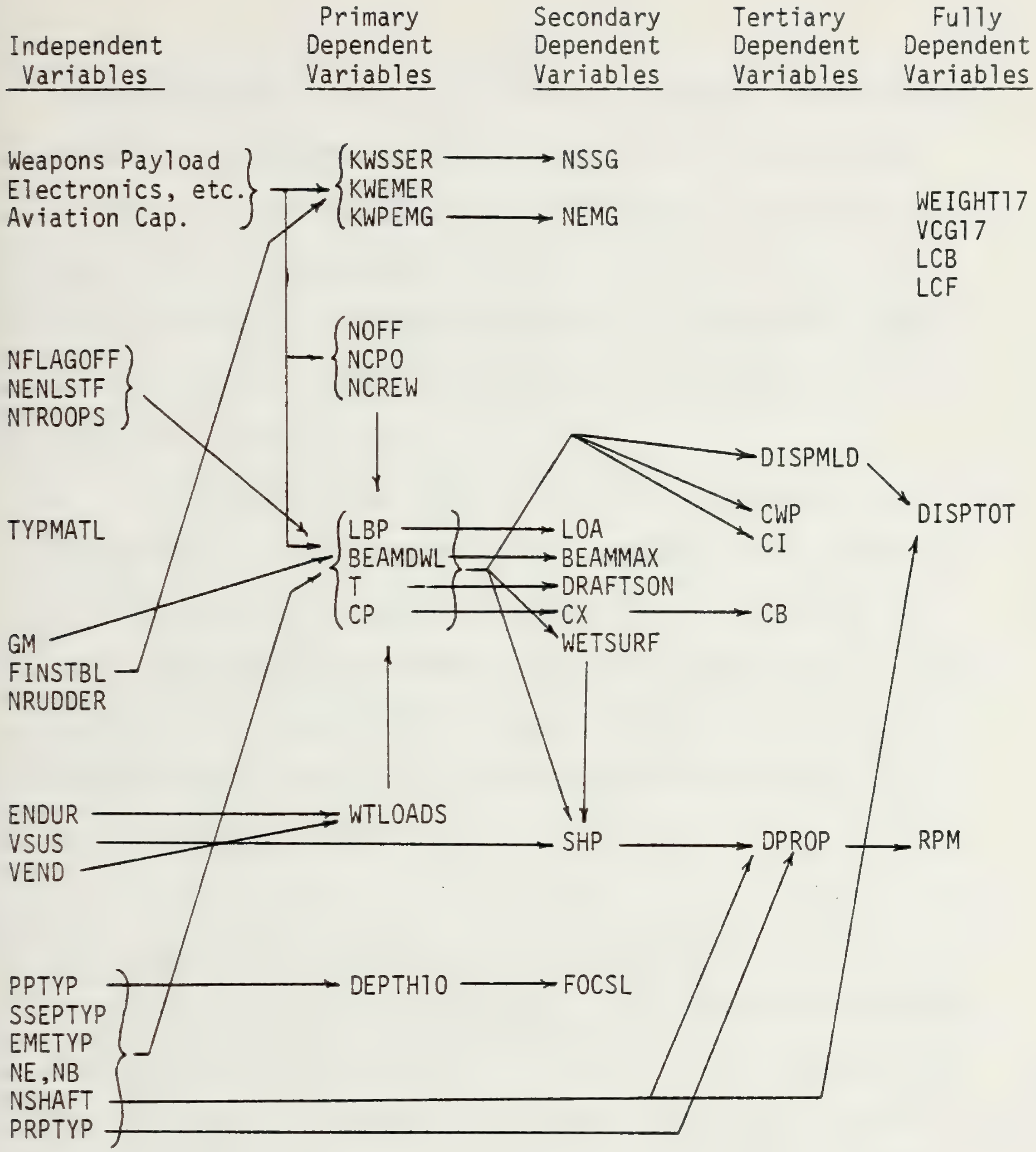


Figure 8-1. General Database Variable Relationships

are estimated first in the design process. The third column is dependent upon values in the first and/or second columns and the fourth column on values in the third and possibly first and/or second column. This table allows the database designer to determine what indices to put on each variable to alert him to check dependent ones.

For example, the dependent variables entry for ENDUR may include the following: WTLOAD, LBP, BEAMDWL, T, CP. A check on LBP will than add to the list of affected variables DISPMLD, DISPTOT, LOA, CWP, CI, LCB, LCF, etc. Although this system requires more work by the database designer, it will make the job of the design manager easier.

8.4 Application of DEX: An Example

8.4.1 Function of MACHWT. The Machinery Weight Estimating (MACHWT) Module was written to demonstrate how DEX and the cruiser-destroyer databases could be used in the preliminary design of a new ship. MACHWT has a fairly limited computation capability since it is only a demonstration module. It enables the user to estimate weight items 200, 201 and 203 based on certain existing parametric equations and parametric equations

developed by the user during the module execution.

These three weight groups are respectively the weight of boilers, weight of propulsion units and weight of the propeller, shafting, and bearings. An analysis of 9 ships for which weight data is available reveals that the sum of these three items constitute between 58.0 and 65.5% of the total Group 2 weight.

The first two weight items are estimated by assuming that they are linearly related to installed horsepower. The program fits a straight line to data extracted from the databases chosen by the user and predicts the new ship weights based on the new specified installed SHP. The program calculates the three component weights of item 203 from the input supplied by the user from any of the valid sources, using parametric equations from the REED model. A summary of the input required for each weight is provided in Table 8-2 (the actual database names are used).

8.4.2 <u>List of Subprograms and Menus</u>. The Machinery Weight Estimating Module includes ten subprograms. They are listed below in the order in which they are most

likely encountered during the execution of the module:

MAINPG
MODIO
INPUT
MWUNIT
MWLIST
MWCHRT
MWCOMP
OUTPUT
MWCOEF
BLOCK DATA
LINFIT

There is actually no one correct sequence of listing the subprograms in the module, other than the requirement that MAINPG be first.

TABLE 8-2

INPUT FOR MACHWT

W200: W200 and SHP from at least two steam ships and SHP of new ship

W201: W201 and SHP from at least two ships and SHP of new ship

W203: LBP, PPTYP, NSHAFT, PRPTYP, VSUS and DPROP (optional) of new ship

Seven of the subprograms employ menus in their operation. These are illustrated in Figure 8-2. A listing of the module subprograms appears as Appendix F. They are described in the next section.

8.4.3 <u>Description of the Subprograms</u>. A description of a typical execution of the module will serve as a backdrop for the subprogram descriptions. The user leaves the DEX level and activates the module by using the "DEX-MAIN" menu item and module labeled

.begin machwt

Subprograms MAINPG and menu "MOD.MAIN" are encountered first. MAINPG is identical to the subprogram of the same name used in the Cube Module described in Chapter 2, as is subprogram MODIO, which would be the next one encountered. The menu selections from these two subprograms are

.read input

These place the user in subroutine INPUT. This subroutine provides the user with a menu permitting him to read, edit, or write the following:

1. All the module input variables.
2. The module input and/or output variables
3. The machinery weight item to be estimated
4. The data from existing ships to be used for curve fitting for weight items W(200) and W(201).

MENU MOD.MAIN
DIALOGUE
INMODE
OUTMODE
READ
EDIT
COMPUT
WRITE
QUIT

MENU MOD.IO
INPUT
OUTPUT
DONE

MENU INPUT
ALL
UNITS
WT.ITEM
CURVEPTS
NEWSHIP
DONE

MENU UNITS
ALL
FORCE
LENGTH
TIME
DONE

MENU WT.ITEM
W200
W201
W203

MENU CHARACT.
LBP
DRAFT
PPTYPE
SHP
MAXSPEED
NO.SHAFT
TYPSCREW
DIAM.PRP
W200
W201
W203

MENU OUTPUT
UNITS
WT.ITEMS
COEFFICI
DONE

Figure 8-2. Machinery Weight Estimating Menus

5. The characteristics of the new ship design needed as input for the weight calculations.

The machinery weight item must be read first to establish the proper value of a variable WFLAG needed by the subsequent subprograms. This will permit the correct prompting messages to be issued to the user for proper input sequencing.

The user can access MWUNIT to specify the length, force and time units to be used for input and output, but he will normally just use the ones initialized in the module in BLOCK DATA. These values are respectively foot, long ton and second, and were chosen to conform with the units of the database variables used. MWUNIT is a shortened version of MXUNIT from the Cube Module.

Returning from or bypassing MWUNIT, the user types

.wt.item w200

to access MWLIST and set WFLAG to indicate weight group 200 to be estimated. MWLIST returns him to INPUT and he selects "curvepts". The following prompting message is issued.

```
*SPECIFY THE SEQUENTIAL NUMBER OF THIS PAIR OF DATA POINTS
*ENTER UP TO   1 INTEGER NUMBERS
```

He types "1" and is presented with menu "CHARACT." from subroutine MWCHRT.

Subroutine MWCHT allows the user to read, edit, or write the characteristics of the ship in question listed in the menu in Figure 8-2. For data points, the independent variable must be read first and the dependent variable next. In this case the user specifies SHP and then W200 and they are read from the open ship database and then inserted into the first positions of an independent variable array and a dependent variable respectively. The user then issues

.done done done

to get back to MAINPG. Using the "inmode" menu selection the user closes the open general database for one steam warship and opens the other one. He then types

.read input curvepts 2 shp yes w200

to input the second pair of data points into the two arrays. The "yes" responds to a question posed by MWCHRT to ascertain if the user is employing horsepower or kilowatts to measure SHP.

This process is repeated for as many ship class databases from which the user wishes to read data for curve fitting, up to a limit of 10. For the purpose of demonstration, the three weight items were stored in the general databases so that only one database for each ship would have to be opened. Normally they re-

side in the weight databases.

When the user is satisfied with the data points read, he specifies "newship" from menu "INPUT" which causes the following message to be issued:

*TO ESTIMATE W(200) OR W(201) INPUT NEW SHIP SHP.
*SELECT WHICH CHARACTERISTIC TO READ.

The user then selects SHP from menu "CHARACT." to complete the input required. He returns to MAINPG and executes the computing program MWCOMP by the following command:

.done done done compute

Once it completes its calculation, MWCOMP returns control to MAINPG, which issues its menu prompting message.

In order to first inspect the coefficients of the straight line fitted to the data, the user (after ensuring that the destination is the terminal) types

.write output coeffici

These commands invoke MODIO, OUTPUT and MWCOEF succesively. The last one causes the two element coefficient array to be printed. The two values which appear are the slope and y-intercept of the straight line.

The user then selects "newship" from menu "OUTPUT" and then "w200" from "CHARACT." and the new estimated boiler weight is printed on the terminal. The user can them return to MAINPG, choose the new ship database

as the destination, and write the estimated W(200) into it. Now, in order to estimate W(201), the user must first exit the module via the "quit" selection from "MOD.MAIN" in order to clear the independent and dependent variable arrays. This is unnecessary if he is going to use at least the same number of data points as for W(200). It is also unnecessary for W(203) which does not require curve fitting.

For W(203), subroutine INPUT prompts the user with the following message when "newship" is chosen:

```
*TO ESTIMATE W(203) THE FOLLOWING INFORMATION IS REQUIRED:
*LBP  PPTYPE  SHP  NSHAFT  PRPTYP  VSUS  DPROP(optional)
```

If DPROP is not specified MWCOMP estimates it.

Simple as it is, MACHWT is more sophisticated than the Cube Module. It is hoped that the listing in Appendix F can serve as a guide to readers preparing a module for use on the DEX.

8.4.4 Results from the MACHWT Module. The module was exercised to estimate W(200) and W(201) for a nominal new ship design having a 40,000 SHP 1200 psi steam plant installed. In order to estimate the weight of boilers, data from the DDG-2, DDG-40, and FF-1052 classes was used. For estimating the weight of the propulsion units, data from the DDG-2, DDG-40, CG-16, CG-26, FF-1052, and

FFG-1 class databases was used.

The REED Model algorithms for the respective weights are as follows:

W200=.00234*SHP+48.09
W201=.00143*SHP+17.92

The MACHWT Module fits the following equations to the data used:

W200=.002585*SHP+31.94
W201=.0017665*SHP+6.66

The respective estimated weights for the new ship appear in Table 8-3.

TABLE 8-3

WEIGHT ESTIMATES FOR 40,000 SHP SHIP DESIGN

	Reed Model	MACHWT
W200 (tons)	141.7	135.3
W201 (tons)	75.1	77.3

8.4.5 Future Developments. MACHWT represents a starting point for what is hoped will be a major ship synthesis program incorporating DEX databases and the REED Model. The model as written contains hundreds of parametric equations for estimating weights, volumes, areas and centers of gravity which were derived from

the data available to its author at that time. As new ships are designed by the Navy, say every 4-5 years, a problem arises with respect to incorporating them into the model. It would be a major undertaking to perform the regression analysis for all new equations. Such a task would have questionable merits since it would probably be found that many equations change only slightly, and others that change drastically have insignificant effects on the overall design. Further, the user would still be confined to using equations of a form chosen by some other designer and derived form those ship classes chosen by him, to which the current user may object.

MACHWT demonstrates a program that allows the user to specify the ship data upon which he wishes to perform a regression analysis. There is no reason why the coefficients obtained could not be written into a database which would be accessed by the REED model in order to estimate that weight item. Expanding on this idea, a program could be developed which allows the user to derive his own coefficients for parametric equations for the large, but not all inclusive, set of variables (weights, volumes, etc.) which impact significantly on the ship design. When a new naval ship class design is

finalized, databases could be produced and stored in the design library at MIT. Only after, perhaps, 3-4 designs and 10-15 years would a major revision of the REED model become worthwhile. The cycle could then begin anew. Not only would this approach avoid frequent rewriting of the REED model, but more importantly, it would allow the individual designer much more control over the tool at his disposal. This would greatly support the function of the department to train naval architects.

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

With the completion of the work of this investigation the first truly capable version of DEX at MIT has been implemented. Current plans call for the adaption to DEX of many of the computer programs in the department and the indoctrination of students to the system. These programs cover a wide range of the calculations which occur during the preliminary design phase.

Two areas of the extended DEX library require development. First is the creation of routines for editing real arrays. Several editing capabilities, similar to those of the operating system, are being considered for implementation, possibly operated by the user by means of an editing menu.

The second area is the task of introducing graphics to the DEX at MIT. An idea to develop routines capable of reading or writing a pair of one-dimensional arrays is under consideration as the means for handling plots. One problem that also must be solved is how to allow the plotting of two curves on the same graph on the screen without any intermediate dialogue between program and user. Although some terminals permit both plotting and

dialogue to occur simultaneously on the screen, many do not, and for DEX to be portable it must be suitable for both types of terminals.

For the purpose of performing ship designs at MIT, this writer perceives the most immediate and imperative need to be the development and implementation of programs which will allow the creation of a table of offsets database. Once the hull form can be defined, the existing programs for hydrostatics, cross-curves of stability, floodable length and Bonjeans, adapted to DEX, can be operated using a common offsets database. Actually, with a hull definition database, the door is open for a significant expansion of the use of the computer in the preliminary design phase including seakeeping, general arrangements, longitudinal strength, etc. Therefore, this task is strongly recommended as a fruitful area for further research.

The adoption of the DEX System entails a change in philosophy on the part of the individual author and user. Heretofore, the programmer required the user to learn how to provide the input, to restrict himself to the design path chosen by the author, and to use the units preferred by the author. With DEX, the user should expect some standardization in the means of input,

flexibility in the path to pursue, and choice in the unit system with which to work. It means more work for the module author, but his job is only performed once, while the advantages he can offer by using DEX will be available to countless users.

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APPENDIX A

CUBE MODULE LISTING

```
C****---------------CUBE MODULE SUBPROGRAM------------------------------
      SUBROUTINE MAINPG
C------------------SUBPROGRAM DESCRIPTION-------------------------------
C SUBROUTINE MAINPG ALLOWS THE USER TO SELECT THE DESIRED PATH IN THE
C EXECUTION OF THIS MODULE.  THE CHOICES ARE
C      1) SET STYLE OF MODULE DIALOGUE
C      2) SELECT SOURCE OF MODULE INPUT
C      3) SELECT DESTINATION OF MODULE OUTPUT
C      4) INTERROGATE THE MODULE FLAGS AND FIND OUT THEIR VALUE
C      5) ACCESS THE MODULE READING ROUINES
C      6) ACCESS THE MODULE EDITING ROUTINES
C      7) ACCESS THE MODULE COMPUTING ROUTINES
C      8) ACCESS THE MODULE WRITING ROUTINES
C      9) RETURN CONTROL TO DEX
C------------------LABELED COMMON VARIABLES-----------------------------
C........RENOS INITIALIZED IN BLOCK DATA
C RNRFIL: FILE REFERENCE NUMBER FOR MODULE FORTRAN READS FROM A
C         SEQUENTIAL FILE
C RNWFIL: FILE REFERENCE NUMBER FOR MODULE FORTRAN WRITES TO A
C         SEQUENTIAL FILE
C........INOUTF INITIALIZED IN BLOCK DATA
C IMODE : DENOTES SOURCE OF MODULE INPUT
C       = 1 A DEX CREATED DATABASE
C       = 2 THE USER EMPLOYING THE TERMINAL TO INPUT ALPHANUMERIC DATA
C           VIA DEX ROUTINES
C       = 3 THE USER EMPLOYING THE SCREEN TO INPUT X-Y COORDINATES VIA
C           DEX ROUTINES
C       = 4 A SEQUENTIAL FILE TO INPUT ALPHANUMERIC DATA WITH FORTRAN
C           READS
C       = 5 THE MODULE DEFAULT DATA.
C OMODE : DENOTES DESTINATION OF MODULE OUTPUT
C       = 1 A DEX CREATED DATABASE
C       = 2 THE TERMINAL USING DEX ROUTINES
C       = 3 THE SCREEN USING PLOTTING ROUTINES
C       = 4 A SEQUENTIAL FILE USING FORTRAN WRITES
C........DIALGF INITIALIZED IN BLOCK DATA
C MTERSE: .TRUE.  IF THE MODULE DIALOGUE IS TERSE
C         .FALSE. IF THE MODULE DIALOGUE IS VERBOSE
C........MDNCPW INITIALIZED IN BLOCK DATA
C NCPW  : NUMBER OF CHARACTERS PER WORD ASSUMED BY DEX ROUTINES
C------------------SUBPROGRAMS AND FUNCTIONS CALLED---------------------
C DEX
C     MENUIN
C     ENDII
C DEX LIBRARY
C     DIALOG
C     SOURCE
C     DESTIN
C     MDMODE
```

```
C MODULE
C     MODIO
C     COMPUT
C-----------------PROGRAMMERS AND REPORT------------------------------
C PROGRAM VERSION: 1
C PROGRAM DATE    : JUNE 1981
C PROGRAMMERS     : C. CHRYSSOSTOMIDIS AND R. CELOTTO
C REPORT          : IDEAS ON HOW TO WRITE DEX MODULES
C                   VOLUME AND WEIGHT OF S.W. PARALLELPIPED
C                   CUBE MODULE ROUTINES
C REPORT NUMBER   : 81-1
C AUTHORS         : C. CHRYSSOSTOMIDIS AND R. CELOTTO
C PUBLISHER       : MASSACHUSETTS INSTITUTE OF TECHNOLOGY
C                   DEPARTMENT OF OCEAN ENGINEERING
C                   DESIGN LABORATORY
C                   CAMBRIDGE MASS 02139 , JUNE 1981
C---------------------------------------------------------------------
C
C LABELED COMMONS FOR SUBROUTINE MAINPG
C
      COMMON /MODEND/MODEND
      COMMON /REFNOS/ RNRFIL,RNWFIL
      COMMON /INOUTF/ IMODE ,OMODE
      COMMON /DIALGF/ MTERSE
      COMMON /MDNCPW/ NCPW
C
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS
C
      INTEGER RNRFIL,RNWFIL
      INTEGER IMODE ,OMODE
      INTEGER NCPW
      INTEGER ITEM,MENUIN,MENUNM(2),NITEMS,ITEMS(18),MESS(1)
      INTEGER IOFLAG
C**** START OF SITE DEPENDENT CODE
      INTEGER DVFLNM(12)
      INTEGER DBFLNM(20)
C**** END   OF SITE DEPENDENT CODE
      LOGICAL MTERSE
C
C VARIABLE DATA DEFINITIONS
C ALL VARIABLES IN LABELLED COMMONS ARE INITIALIZED IN BLOCK DATA
C
      DATA MESS  /4H<  /
      DATA MENUNM/4HMOD.,4HMAIN/
      DATA NITEMS/9/
      DATA ITEMS /4HDIAL,4HOGUE,
     1           4HINMO,4HDE  ,
     2           4HOUTM,4HODE ,
     3           4HMOD.,4HMODE,
```

```
     4              4HREAD,4H    ,
     5              4HEDIT,4H    ,
     6              4HCOMP,4HUTE ,
     7              4HWRIT,4HE   ,
     8              4HQUIT,4H    /
C
C SELECT AN ITEM FROM MENU MOD.MAIN AND BRANCH ACCORDINGLY
C
   50 CONTINUE
      ITEM=MENUIN(MENUNM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300,400,500,600,700,800,900),ITEM
C
C SET STYLE OF MODULE DIALOGUE.
C
  100 CONTINUE
      CALL DIALOG(MTERSE)
      GO TO 50
C
C SELECT SOURCE OF MODULE INPUT.
C
  200 CONTINUE
      CALL SOURCE(IMODE,DBFLNM,DVFLNM,RNRFIL,MTERSE,NCPW)
      GO TO 50
C
C SELECT DESTINATION OF MODULE OUTPUT.
C
  300 CONTINUE
      CALL DESTIN(OMODE,DBFLNM,DVFLNM,RNWFIL,MTERSE,NCPW)
      GO TO 50
C
C SUPPLY INFORMATION ABOUT THE MODULE FLAGS.
C
  400 CONTINUE
      CALL MDMODE(IMODE,OMODE,RNRFIL,RNWFIL,MTERSE,
     .            NCPW)
      GO TO 50
C
C ACCESS THE MODULE READING ROUTINES.
C
  500 CONTINUE
      IOFLAG=1
      CALL MODIO(IOFLAG)
      GO TO 50
C
C ACCESS THE MODULE EDITING ROUTINES.
C
  600 CONTINUE
      IOFLAG=2
      CALL MODIO(IOFLAG)
```

```
      GO TO 50
C
C ACCESS THE MODULE COMPUTING ROUTINES.
C
  700 CONTINUE
      CALL COMPUT
      GO TO 50
C
C ACCESS THE MODULE WRITING ROUTINES.
C
  800 CONTINUE
      IOFLAG=3
      CALL MODIO(IOFLAG)
      GO TO 50
C
C RETURN CONTROL TO DEX.
C
  900 CONTINUE
      CALL ENDIT
      RETURN
      END
```

```
C-------------------CUBE MODULE SUBPROGRAM------------------------------MOD00010
      SUBROUTINE MODIO(IOFLAG)                                          MOD00020
C-------------------SUBPROGRAM DESCRIPTION------------------------------MOD00030
C SUBROUTINE MODIO ENABLES ITS USERS TO SELECT THE SEGMENT OR SEGMENTS  MOD00040
C OF THE MODULE'S VARIABLES THEY WISH TO READ, EDIT OR WRITE.           MOD00050
C THE CHOICES ARE:                                                      MOD00060
C          BOTH INPUT AND OUTPUT MODULE VARIABLES                       MOD00070
C          INPUT MODULE VARIABLES                                       MOD00080
C          OUTPUT MODULE VARIABLES                                      MOD00090
C-------------------INPUT VARIABLES-------------------------------------MOD00100
C IOFLAG=1 IF THIS SUBROUTINE WAS INVOKED BY ITEM READ OF MENU MOD.MAIN MOD00110
C        2                                         EDIT                 MOD00120
C        3                                         WRITE                MOD00130
C-------------------LABELED COMMON VARIABLES----------------------------MOD00140
C LABELLED COMMON DIALGF HAS BEEN DEFINED IN SUBROUTINE MAINPG.         MOD00150
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------MOD00160
C DEX                                                                   MOD00170
C     SIRPAK                                                            MOD00180
C     LMOVEC                                                            MOD00190
C     MENUIN                                                            MOD00200
C DEX LIBRARY                                                           MOD00210
C     NONE                                                              MOD00220
C MODULE                                                                MOD00230
C     INPUT                                                             MOD00240
C     OUTPUT                                                            MOD00250
C-----------------------------------------------------------------------MOD00260
C                                                                       MOD00270
C LABELED COMMONS                                                       MOD00280
C                                                                       MOD00290
      COMMON /DIALGF/ MTERSE                                            MOD00300
      COMMON /MDNCPW/ NCPW                                              MOD00310
C                                                                       MOD00320
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                 MOD00330
C                                                                       MOD00340
      INTEGER IOFLAG                                                    MOD00350
      INTEGER MESS(15),LMS,NCPW                                         MOD00360
      INTEGER ITEM,MENUIN,MENUNM(2),NITEMS,ITEMS(8)                     MOD00370
      INTEGER READ(2),EDIT(2),WRITE(2)                                  MOD00380
      LOGICAL MTERSE                                                    MOD00390
      LOGICAL ALLFLG,LOGVAL,LMOVEC                                      MOD00400
C                                                                       MOD00410
C VARIABLE DATA DEFINITIONS                                             MOD00420
C                                                                       MOD00430
      DATA LMS   /15/                                                   MOD00440
      DATA MENUNM/4HMOD.,4HIO  /                                        MOD00450
```

```
      DATA NITEMS/4/
      DATA ITEMS /4HALL ,4H    ,
     2            4HINPU,4HT   ,
     3            4HOUTP,4HUT  ,
     4            4HDONE,4H    /
      DATA READ /4HREAD,4H.<  /
      DATA EDIT /4HEDIT,4H.<  /
      DATA WRITE/4HWRIT,4HE.< /
C
C INITIALIZE ALLFLG.
C
      ALLFLG=.FALSE.
C
C PREPARE PROMPTING MESSAGE FOR MENU 'MOD.IO'.
C
      IF (MTERSE) GO TO 10
      CALL STRPAK(MESS,LMS,4H<   ,41HSELECT WHICH MODULE VARIABLE SEGMEN
     *T TO<)
      LPOSN=41
      GO TO 20
   10 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,27HWHICH VARIABLE SEGMENT TO<)
      LPOSN=27
   20 CONTINUE
      GO TO (25,30,35),IOFLAG
   25 CONTINUE
      LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,LPOSN,NCPW)
      GO TO 50
   30 CONTINUE
      LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,LPOSN,NCPW)
      GO TO 50
   35 CONTINUE
      LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,LPOSN,NCPW)
C
C SELECT AN ITEM FROM MENU 'MOD.IO' AND BRANCH ACCORDINGLY.
C
   50 CONTINUE
      ITEM=MENUIN(MENUNM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300,400),ITEM
C
C ACTIVATE THE SUBPROGRAM'S ALL OPTION.
C
  100 CONTINUE
      ALLFLG=.TRUE.
C
```

```
C READ MODULE INPUT DATA.
C
  200 CONTINUE
      CALL INPUT(ALLFLG,IOFLAG)
      IF (.NOT.ALLFLG) GO TO 50
C
C READ MODULE OUTPUT DATA.
C
  300 CONTINUE
      CALL OUTPUT(ALLFLG,IOFLAG)
      IF (.NOT.ALLFLG) GO TO 50
C
C RETURN CONTROL TO THE CALLING PROGRAM.
C
  400 CONTINUE
      RETURN
      END
```

```
C-------------------CUBE MODULE SUBPROGRAM----------------------------
      SUBROUTINE INPUT(CALALL,IOFLAG)
C-------------------SUBPROGRAM DESCRIPTION---------------------------
C     SUBROUTINE INPUT PROVIDES THE USER WITH A MENU FROM WHICH TO
C CHOOSE WHICH MODULE SEGMENT IT IS DESIRED TO OPERATE NEXT.  THE
C CHOICES ARE:
C          ALL MODULE INPUT VARIABLES
C          THE MODULE UNITS TO BE USED DURING INPUT AND OUTPUT
C          THE MODULE DIMENSIONS
C     THE UNITS MODULE ALLOWS THE USER TO SPECIFY THE LENGTH AND FORCE
C UNITS TO BE USED DURING INPUT AND OUTPUT.  THE DIMENSIONS MODULE
C ALLOWS THE USER TO READ, EDIT OR WRITE THE CUBE DIMENSIONS: LENGTH,
C WIDTH AND HEIGHT.
C     IF THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE, THE
C LOCALL ALL OPTION IS SET TO .TRUE. UPON INVOKING THIS SUBROUTINE.
C IN THIS CASE THE MENU 'INPUT' IS NOT DEFINED.
C-------------------SUBPROGRAM ASSUMPTIONS-----------------------------
C NONE YET.
C-------------------OUTPUT VARIABLES-----------------------------------
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR
C                 OCCURRED WHEN READING OR EDITING AN ESSENTIAL INPUT
C                 VARIABLE
C        .FALSE.  IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR
C                 OCCURRED WHEN READING OR EDITING AN ESSENTIAL INPUT
C                 VARIABLE
C-------------------INPUT VARIABLES------------------------------------
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE
C        .FALSE.  THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE
C IOFLAG=1 IF THE USER WISHES TO READ THE VARIABLES
C        2                      EDIT
C        3                      WRITE
C----------------------LABELED COMMON VARIABLES------------------------
C LABELED COMMON DIALGF HAS BEEN DEFINED IN SUBROUTINE MAINPG.
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED-------------------
C DEX
C     SIRPAK
C     LMOVEC
C     MENUIN
C DEX LIBRARY
C     NONE
C MODULE
C     MXUNIT
C     DIMENS
C---------------------------------------------------------------------
C
C LABELED COMMONS
C
```

```
      COMMON /DIALGI/ MTERSE                                            INP00480
      COMMON /MDNCPW/ NCPW                                              INP00490
C                                                                       INP00500
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                 INP00510
C                                                                       INP00520
      INTEGER IOFLAG                                                    INP00530
      INTEGER MENUNM(2),NITEMS,ITEMS(8),ITEM                            INP00540
      INTEGER MESS(15),LMS,NCPW                                         INP00550
      INTEGER READ(2),EDIT(2),WRITE(2)                                  INP00560
      LOGICAL CALALL,LOCALL                                             INP00570
      LOGICAL MTERSE,LOGVAL,LMOVEC                                      INP00580
C                                                                       INP00590
C VARIABLE DATA DEFINITIONS                                             INP00600
C                                                                       INP00610
      DATA LMS/15/                                                      INP00620
      DATA MENUNM/4HINPU,4HT   /                                        INP00630
      DATA NITEMS/4/                                                    INP00640
      DATA ITEMS/4HALL ,4H    ,                                         INP00650
     1           4HUNIT,4HS   ,                                         INP00660
     2           4HDIME,4HNSIO,                                         INP00670
     3           4HDONE,4H    /                                         INP00680
      DATA LOCALL/.FALSE./                                              INP00690
      DATA READ /4HREAD,4H.< /                                         INP00700
      DATA EDIT /4HEDIT,4H.< /                                         INP00710
      DATA WRITE/4HWRIT,4HE.< /                                        INP00720
C                                                                       INP00730
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.     INP00740
C NOTE THAT IF THE LOCAL ALL OPTION IS SET IN THIS MANNER, THE MENU     INP00750
C 'INPUT' IS NOT DEFINED BY THE INVOCATION OF THIS SUBROUTINE.          INP00760
C                                                                       INP00770
      LOCALL=CALALL                                                     INP00780
      IF (LOCALL) GO TO 200                                             INP00790
C                                                                       INP00800
C PREPARE A PROMPTING MESSAGE FOR MENU 'INPUT' AND THEN PROVIDE THE     INP00810
C MENU TO THE USER.                                                     INP00820
C                                                                       INP00830
      IF (MTERSE) GO TO 40                                              INP00840
      CALL STRPAK(MESS,LMS,4H<   ,40HSELECT WHICH INPUT VARIABLE SEGMENTINP00850
     1 10<)                                                            INP00860
      GO TO (10,20,30),IOFLAG                                           INP00870
   10 LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,40,NCPW)                         INP00880
      GO TO 50                                                          INP00890
   20 LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,40,NCPW)                         INP00900
      GO TO 50                                                          INP00910
   30 LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,40,NCPW)                        INP00920
      GO TO 50                                                          INP00930
   40 CALL STRPAK(MESS,LMS,4H<   ,21HWHICH INPUT SEGMENT?<            INP00940
```

```
   50 CONTINUE
      ITEM MENUIN(MENUNM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300,400),ITEM
C
C SET THE INPUT ALL OPTION.
C
  100 CONTINUE
      LOCALL=.TRUE.
C
C READ, EDIT OR WRITE THE INPUT/OUTPUT MODULE UNITS.
C
  200 CONTINUE
      CALL MXUNIT(LOCALL,IOFLAG)
      IF (LOCALL) GO TO 300
      IF (.NOT.CALALL) GO TO 50
      CALALL=.FALSE.
      GO TO 400
C
C CALL DIMENS TO READ, EDIT OR WRITE THE CUBE DIMENSIONS.
C
  300 CONTINUE
      CALL DIMENS(LOCALL,IOFLAG)
      IF (LOCALL) GO TO 400
      IF (.NOT.CALALL) GO TO 50
      CALALL=.FALSE.
C
C RETURN CONTROL TO CALLING PROGRAM.
C
  400 CONTINUE
      RETURN
      END
```

```
C-------------------CUBE MODULE SUBPROGRAM------------------------------MXU00010
      SUBROUTINE MXUNIT(CALALL,IOFLAG)                                  MXU00020
C-------------------SUBPROGRAM DESCRIPTION------------------------------MXU00030
C SUBROUTINE MXUNIT ALLOWS ITS USERS TO SELECT WHICH MODULE UNIT THEY   MXU00040
C WISH TO READ, EDIT OR WRITE.  THE CHOICES ARE:                        MXU00050
C         ALL MODULE       UNITS                                        MXU00060
C         THE LENGTH       UNIT                                         MXU00070
C         THE TIME         UNIT                                         MXU00080
C         THE FORCE        UNIT                                         MXU00090
C         THE PLANE ANGLE UNIT                                          MXU00100
C         THE TEMPERATURE UNIT                                          MXU00110
C-------------------SUBPROGRAM ASSUMPTIONS------------------------------MXU00120
C IF THE CALLING PROGRAM ALL OPTION IS ACTIVE, THE LOCAL ALL OPTION IS  MXU00130
C SET TO .TRUE. UPON INVOKING THIS SUBROUTINE.  IN THIS CASE THE MENU ISMXU00140
C NOT DEFINED.                                                          MXU00150
C-------------------OUTPUT VARIABLES------------------------------------MXU00160
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR  MXU00170
C                 OCCURRED IN READING OR EDITING A MODULE UNIT          MXU00180
C         .FALSE. IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR  MXU00190
C                 OCCURRED IN READING OR EDITING A MODULE UNIT          MXU00200
C-------------------INPUT VARIABLES-------------------------------------MXU00210
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE       MXU00220
C         .FALSE. THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE   MXU00230
C IOFLAG=1 IF THE USER WISHES TO READ MODULE UNITS                      MXU00240
C        2                      EDIT                                    MXU00250
C        3                      WRITE                                   MXU00260
C-------------------LABELED COMMON VARIABLES----------------------------MXU00270
C LABELED COMMON DIALGF, INOUTF, MDNCPW AND REFNOS HAVE BEEN DEFINED IN MXU00280
C SUBROUTINE MAINPG.                                                    MXU00290
C......LUNITS INITIALIZED IN BLOCK DATA                                 MXU00300
C PSTLUN= / THE PROGRAM STANDARD LENGTH UNIT IS METER                   MXU00310
C UIOLUN: DENOTES THE INPUT/OUTPUT LENGTH UNIT                          MXU00320
C       = 1 IF THE INPUT/OUTPUT LENGTH UNIT IS INCH                     MXU00330
C       = 2                                    FOOT                     MXU00340
C       = 3                                    STATUTE MILE             MXU00350
C       = 4                                    NAUTICAL MILE            MXU00360
C       = 5                                    MILLIMETER               MXU00370
C       = 6                                    CENTIMETER               MXU00380
C       = 7                                    METER                    MXU00390
C       = 8                                    KILOMETER                MXU00400
C......LUINFO INITIALIZED IN BLOCK DATA                                 MXU00410
C DBLUNN: WHERE THE DATABASE NAME OF THE LENGTH UNIT IS STORED          MXU00420
C DBLUNC: WHERE INFORMATION FOR IDENTIFYING THE LENGTH UNIT VARIABLE    MXU00430
C         IS STORED                                                     MXU00440
C LUNFRM: FORMAT TO BE USED TO READ OR WRITE THE LENGTH UNIT FROM A     MXU00450
C         SEQUENTIAL FILE                                               MXU00460
C DEFLUN: THE DEFAULT VALUE OF THE LENGTH UNIT                          MXU00470
```

```
C SUBPROGRAM BLOCK DATA.                                                 MXU00480
C......FUNITS INITIALIZED IN BLOCK DATA                                  MXU00490
C PSTFUN= 7 THE PROGRAM STANDARD FORCE UNIT IS KILOPOND                  MXU00500
C UIOFUN: DENOTES THE INPUT/OUTPUT FORCE UNIT                            MXU00510
C        = 1 IF THE INPUT/OUTPUT FORCE UNIT IS POUNDAL                   MXU00520
C        = 2                                   POUND(FORCE)              MXU00530
C        = 3                                   SHORT TON                 MXU00540
C        = 4                                   LONG TON                  MXU00550
C        = 5                                   DYNE                      MXU00560
C        = 6                                   NEWTON                    MXU00570
C        = 7                                   KILOPOND                  MXU00580
C......FUINFO INITIALIZED IN BLOCK DATA                                  MXU00590
C DBFUNN: WHERE THE DATABASE NAME OF THE FORCE UNIT IS STORED            MXU00600
C DBFUNC: WHERE INFORMATION FOR IDENTIFYING THE FORCE UNIT VARIABLE      MXU00610
C         IS STORED                                                      MXU00620
C FUNFRM: FORMAT TO BE USED TO READ OR WRITE THE FORCE UNIT TO A SE-     MXU00630
C         QUENTIAL FILE                                                  MXU00640
C DEFFUN: THE DEFAULT VALUE OF THE FORCE UNIT                            MXU00650
C.....TUNITS INITIALIZED IN BLOCK DATA                                   MXU00660
C PSTTUN= 1 THE PROGRAM STANDARD TIME UNIT IS SECOND                     MXU00670
C UIOTUN: DENOTES THE INPUT/OUTPUT TIME UNIT                             MXU00680
C        = 1 IF THE INPUT7OUTPUT TIME UNIT IS SECOND                     MXU00690
C        = 2                                  MINUTE                     MXU00700
C        = 3                                  HOUR                       MXU00710
C        = 4                                  DAY                        MXU00720
C        = 5                                  WEEK                       MXU00730
C        = 6                                  MONTH (30 DAY MONTH)       MXU00740
C        = 7                                  YEAR (360 DAY YEAR)        MXU00750
C......TUINFO INITIALIZED IN BLOCK DATA                                  MXU00760
C DBTUNN: WHERE THE DATABASE NAME OF THE TIME UNIT IS STORED             MXU00770
C DBTUNC: WHERE INFORMATION FOR IDENTIFYING THE TIME UNIT VARIABLE IS    MXU00780
C         STORED                                                         MXU00790
C TUNFRM: FORMAT TO BE USED TO READ THE TIME UNIT FROM OR WRITE IT TO A MXU00800
C         SEQUENTIAL FILE                                                MXU00810
C DEFTUN: THE DEFAULT VALUE OF THE TIME UNIT                             MXU00820
C......AUNITS INITIALIZED IN BLOCK DATA                                  MXU00830
C PSTAUN= 1 THE PROGRAM STANDARD PLANE ANGLE UNIT IS CYCLE               MXU00840
C UIOAUN: DENOTES THE INPUT/OUTPUT ANGLE UNIT                            MXU00850
C        = 1 IF THE INPUT/OUTPUT ANGLE UNIT IS CYCLE                     MXU00860
C        = 2                                   RADIAN                    MXU00870
C        = 3                                   DEGREE (ANG)              MXU00880
C        = 4                                   MINUTE (ANG)              MXU00890
C        = 5                                   SECOND (ANG)              MXU00900
C......AUINFO INITIALIZED IN BLOCK DATA                                  MXU00910
C DBAUNN: WHERE THE DATABASE NAME OF THE ANGLE UNIT IS STORED            MXU00920
C DBAUNC: WHERE INFORMATION FOR IDENTIFYING THE ANGLE UNIT VARIABLE      MXU00930
C         IS STORED                                                      MXU00940
```

```
C AUNFRM: FORMAT TO BE USED TO READ THE ANGLE UNIT TO OR WRITE IT FROM  MXU00950
C         A SEQUENTIAL FILE                                              MXU00960
C DEFAUN: THE DEFAULT VALUE OF THE ANGLE UNIT                            MXU00970
C......TPUNTS INITIALIZED IN BLOCK DATA                                  MXU00980
C PSTPUN= 1 THE PROGRAM STANDARD TEMPERATURE UNIT IS CELCIUS DEGREES     MXU00990
C UIOTPU: DENOTES THE INPUT/OUTPUT TEMPERATURE UNIT                      MXU01000
C       = 1 IF THE INPUT/OUTPUT TEMPERATURE UNIT IS CELCIUS DEGREES      MXU01010
C       = 2                                         FAHRENHEIT DEGREES   MXU01020
C       = 3                                         KELVIN DEGREES       MXU01030
C       = 4                                         RANKINE DEGREES      MXU01040
C......TPINFO INITIALIZED IN BLOCK DATA                                  MXU01050
C DBTPUN: WHERE THE DATABASE NAME FOR THE TEMPERATURE UNIT IS STORED     MXU01060
C DBTPUC: WHERE INFORMATION FOR IDENTIFYING THE TEMPERATURE UNIT         MXU01070
C         VARIABLE IS STORED                                             MXU01080
C TPUFRM: FORMAT TO BE USED TO READ THE TEMPERATURE UNIT FROM OR WRITE   MXU01090
C         IT TO A SEQUENTIAL FILE                                        MXU01100
C DEFTPU: THE DEFAULT VALUE OF THE TEMPERATURE UNIT                      MXU01110
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------MXU01120
C DEX                                                                    MXU01130
C     STRPAK                                                             MXU01140
C     EMOVEC                                                             MXU01150
C     MENUIN                                                             MXU01160
C DEX LIBRARY                                                            MXU01170
C     NONE                                                               MXU01180
C MODULE                                                                 MXU01190
C     LUNIT                                                              MXU01200
C     TUNIT                                                              MXU01210
C     FUNIT                                                              MXU01220
C     AUNIT                                                              MXU01230
C     TPUNIT                                                             MXU01240
C-----------------------------------------------------------------------MXU01250
C                                                                        MXU01260
C LABELED COMMONS                                                        MXU01270
C                                                                        MXU01280
      COMMON /DIALGT/ MIERSE                                             MXU01290
      COMMON /INOUTF/ IMODE,OMODE                                        MXU01300
      COMMON /MDNCPW/ NCPW                                               MXU01310
      COMMON /REFNOS/ RNRFIL,RNWFIL                                      MXU01320
      COMMON /LUNITS/ PSTLUN,UIOLUN                                      MXU01330
      COMMON /TUNITS/ PSTTUN,UIOTUN                                      MXU01340
      COMMON /FUNITS/ PSTFUN,UIOFUN                                      MXU01350
      COMMON /AUNITS/ PSTAUN,UIOAUN                                      MXU01360
      COMMON /TPUNTS/ PSTPUN,UIOTPU                                      MXU01370
      COMMON /LUINFO/ DBLUNN,DBLUNC,LUNFRM,DEFLUN                        MXU01380
      COMMON /TUINFO/ DBTUNN,DBTUNC,TUNFRM,DEFTUN                        MXU01390
      COMMON /FUINFO/ DBFUNN,DBFUNC,FUNFRM,DEFFUN                        MXU01400
      COMMON /AUINFO/ DBAUNN,DBAUNC,AUNFRM,DEFAUN                        MXU01410
```

```
      COMMON /IPINFO/ DBTPUN,DBTPUC,TPUFRM,DEFTPU                       MXU01420
C                                                                       MXU01430
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                  MXU01440
C                                                                       MXU01450
      INTEGER IOFLAG                                                    MXU01460
      INTEGER IMODE,OMODE,IOMODE                                        MXU01470
      INTEGER MESS(11),IMS,NCPW                                         MXU01480
      INTEGER ITEM,MFNUIN,MFNUNM(2),NITEMS,ITEMS(14)                    MXU01490
      INTEGER UIOLUN,UIOTUN,UIOFUN,UIOAUN,UIOTPU                        MXU01500
      INTEGER DBLUNN(2),DBTUNN(2),DBFUNN(2),DBAUNN(2),DBTPUN(2)         MXU01510
      INTEGER DBLUNC(16),DBTUNC(16),DBFUNC(16),DBAUNC(16),DBTPUC(16)    MXU01520
      INTEGER LUNFRM(2),TUNFRM(2),FUNFRM(2),AUNFRM(2),TPUFRM(2)         MXU01530
      INTEGER DEFLUN,DEFTUN,DEFFUN,DEFAUN,DEFTPU                        MXU01540
      INTEGER RNRFIL,RNWFIL,RNFILE                                      MXU01550
      INTEGER PSTLUN,PSTTUN,PSTFUN,PSTAUN,PSTPUN                        MXU01560
      INTEGER PMES(16)                                                  MXU01570
      INTEGER READ(2),EDIT(2),WRITE(2)                                  MXU01580
      LOGICAL MTLRSE,PMPREP                                             MXU01590
      LOGICAL CALALL,LOCALL                                             MXU01600
      LOGICAL LOGVAL,LMOVEC                                             MXU01610
C                                                                       MXU01620
C VARIABLE DATA DEFINITIONS                                             MXU01630
C                                                                       MXU01640
      DATA IMS   /11/                                                   MXU01650
      DATA MENUNM/4HUNIT,4H    /                                        MXU01660
      DATA NITEMS/7/                                                    MXU01670
      DATA ITEMS /4HALL ,4H    ,                                        MXU01680
     2            4HLENG,4HTH  ,                                        MXU01690
     3            4HTIME,4H    ,                                        MXU01700
     4            4HFORC,4HE   ,                                        MXU01710
     5            4HPLAN,4HEANG,                                        MXU01720
     6            4HTEMP,4H    ,                                        MXU01730
     7            4HDONE,4H    /                                        MXU01740
      DATA READ /4HREAD,4H.< /                                         MXU01750
      DATA EDIT /4HEDIT,4H.< /                                         MXU01760
      DATA WRITE/4HWRIT,4HE.</                                         MXU01770
C                                                                       MXU01780
C INITIALIZE THE VALUE OF PMPREP.                                       MXU01790
C                                                                       MXU01800
      PMPREP=.TRUE.                                                     MXU01810
C                                                                       MXU01820
C SET THE VALUE OF IOMODE AND RNFILE ACCORDING TO WHETHER THE           MXU01830
C USER WISHES TO READ, EDIT OR WRITE.                                   MXU01840
C                                                                       MXU01850
      IF (IOFLAG.EQ.3) GO TO 10                                         MXU01860
      IOMODE=IMODE                                                      MXU01870
      RNFILE=RNRFIL                                                     MXU01880
```

```
      GO TO 15
   10 IOMODE=OMODE
      RNFILE=RNWFIL
C
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.
C NOTE THAT IF THE LOCAL ALL OPTION IS SET IN THIS MANNER, MENU 'UNIT'
C IS NOT DEFINED BY THE INVOCATION OF THIS SUBROUTINE.
C
   15 CONTINUE
      LOCALL=CALALL
      IF (LOCALL) GO TO 200
C
C PREPARE PROMPTING MESSAGE FOR MENU 'UNIT'.
C
   20 IF (MTERSE) GO TO 40
      CALL STRPAK(MESS,LMS,4H<   ,22HSELECT WHICH UNIT TO<)
      GO TO (25,30,35),IOFLAG
   25 CONTINUE
      LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,22,NCPW)
      GO TO 50
   30 CONTINUE
      LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,22,NCPW)
      GO TO 50
   35 CONTINUE
      LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,22,NCPW)
      GO TO 50
   40 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,12HWHICH UNIT?<)
C
C SELECT AN ITEM FROM MENU 'UNIT' AND BRANCH ACCORDINGLY.
C
   50 CONTINUE
      ITEM MENUIN(MENUNM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300,400,500,600,700),ITEM
C
C ACTIVATE THE SUBPROGRAM'S ALL OPTION.
C
  100 CONTINUE
      LOCALL=.TRUE.
C
C READ, EDIT OR WRITE THE LENGTH UNIT.
C
  200 CONTINUE
      CALL LUNIT(UIOLUN,LOCALL,
     1           IOFLAG,IOMODE,MTERSE,NCPW,
     2           DBLUNN,DBLUNC,
     3           PMPREP,PMES,
```

```
     4            RNFILE,LUNFRM,
     5            DEFLUN)
      IF (LOCALL) GO TO 300
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
      GO TO 700
C
C READ, EDIT OR WRITE THE TIME UNIT.
C
  300 CONTINUE
      CALL TUNIT(UIOTUN,LOCALL,
     1            IOFLAG,IOMODE,MTERSE,NCPW,
     2            DBTUNN,DBTUNC,
     3            PMPREP,PMES,
     4            RNFILE,TUNFRM,
     5            DEFTUN)
      IF (LOCALL) GO TO 400
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
      GO TO 700
C
C READ, EDIT OR WRITE THE FORCE UNIT.
C
  400 CONTINUE
      CALL FUNIT(UIOFUN,LOCALL,
     1            IOFLAG,IOMODE,MTERSE,NCPW,
     2            DBFUNN,DBFUNC,
     3            PMPREP,PMES,
     4            RNFILE,FUNFRM,
     5            DEFFUN)
      IF (LOCALL) GO TO 500
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
      GO TO 700
C
C READ, EDIT OR WRITE THE PLANE ANGLE UNIT.
C
  500 CONTINUE
      CALL AUNIT(UIOAUN,LOCALL,
     1            IOFLAG,IOMODE,MTERSE,NCPW,
     2            DBAUNN,DBAUNC,
     3            PMPREP,PMES,
     4            RNFILE,AUNFRM,
     5            DEFAUN)
      IF(LOCALL) GO TO 600
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
```

```
      GO TO 700                                                         MXU02830
C                                                                       MXU02840
C READ, EDIT OR WRITE THE TEMPERATURE UNIT.                             MXU02850
C                                                                       MXU02860
  600 CONTINUE                                                          MXU02870
      CALL TPUNIT(UIOTPU,LOCALL,                                        MXU02880
     1            IOFLAG,IOMODE,MTERSE,NCPW,                            MXU02890
     2            DBIPUN,DBIPUC,                                        MXU02900
     3            PMPREP,PMES,                                          MXU02910
     4            RNFILE,TPUFRM,                                        MXU02920
     5            DEFIPU)                                               MXU02930
      IF (LOCALL) GO TO 700                                             MXU02940
      IF (.NOT.CALALL) GO TO 20                                         MXU02950
      CALALL=.FALSE.                                                    MXU02960
C                                                                       MXU02970
C RETURN CONTROL TO THE CALLING PROGRAM.                                MXU02980
C                                                                       MXU02990
  700 CONTINUE                                                          MXU03000
      RETURN                                                            MXU03010
      END                                                               MXU03020
```

```
C-------------------CUBE MODULE SUBPROGRAM----------------------------
      SUBROUTINE DIMENS(ALLFLG,IOFLAG)
C-------------------SUBPROGRAM DESCRIPTION---------------------------
C    SUBROUTINE DIMENS FIRST CALLS UNITLF TO OBTAIN THE MULTIPLI-
C CATIVE LENGTH CONVERSION FACTOR AND THE NAMES OF THE LENGTH UNITS
C TO BE USED DURING INPUT.  DIMENS THEN PROVIDES A MENU FROM
C FROM WHICH THE USER SELECTS WHICH DIMENSION IT IS DESIRED TO READ,
C EDIT OR WRITE.  THE CHOICES ARE:
C             ALL DIMENSIONS
C             LENGTH
C             WIDTH
C             HEIGHT
C    IF THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE, THE LOCAL
C ALL OPTION IS SET TO .TRUE. UPON INVOKING THIS SUBROUTINE AND THE
C MENU IS NOT DISPLAYED.
C-------------------SUBPROGRAM ASSUMPTIONS--------------------------------
C NONE YET
C-------------------OUTPUT VARIABLES--------------------------------------
C ALLFLG: .TRUE.  IF THE INPUT VALUE OF ALLFLG WAS .TRUE. AND NO
C                 ERROR OCCURED WHEN READING A UNIT OR EDITING ANY
C                 DIMENSION
C         .FALSE. IF THE INPUT VALUE OF ALLFLG WAS .FALSE. OR AN
C                 ERROR OCCURED WHEN READING A UNIT OR EDITING A
C                 DIMENSION
C-------------------INPUT VARIABLES---------------------------------------
C ALLFLG: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE
C       : .FALSE. THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE
C IOFLAG=1 IF THE USER WISHES TO INVOKE RSCLDR
C        2                             RSCEDT
C        3                             RSCDMP
C--------------------LABELED COMMON VARIABLES-------------------------
C LABELED COMMONS DIALGF,INOUTF,MDNCPW AND REFNOS HAVE BEEN DEFINED
C IN SUBROUTINE MAINPG.  LABELED COMMON LUNITS HAS BEEN DEFINED IN
C SUBROUTINE MXUNIT.
C......LINFO INITIALIZED IN BLOCK DATA
C L     : LENGTH OF THE CUBE IN PROGRAM STANDARD UNITS
C LENNAM: DATABASE NAME FOR LENGTH
C LMORGN: DATABASE COMMENT DESCRIBING LENGTH
C DEFALL: THE DEFAULT VALUE FOR LENGTH
C......WINFO INITIALIZED IN BLOCK DATA
C W     : WIDTH OF THE CUBE IN PROGRAM STANDARD UNITS
C WEINAM: DATABASE NAME FOR WIDTH
C WMORGN: DATABASE COMMENT DESCRIBING WIDTH
C DEFALW: THE DEFAULT VALUE FOR WIDTH
C......HINFO INITIALIZED IN BLOCK DATA
C H     : HEIGHT OF THE CUBE IN PROGRAM STANDARD UNITS
C HEINAM: DATABASE NAME FOR HEIGHT
```

```
C HMORGN: DATABASE COMMENT DESCRIBING HEIGHT                            DIM00480
C NDEFH : THE NUMBER OF HEIGHT DEFAULT VALUES                            DIM00490
C DEFALH: THE DEFAULT VALUES FOR HEIGHT                                  DIM00500
C......DIMFRM INITIALIZED IN BLOCK DATA                                  DIM00510
C LWFRM : FORMAT TO BE USED FOR THE LENGTH AND WIDTH DIMENSIONS WHEN     DIM00520
C         READING FROM OR WRITING TO A SEQUENTIAL FILE                   DIM00530
C HFRM  : FORMAT TO BE USED FOR THE HEIGHT DIMENSION WHEN READING FROM   DIM00540
C         OR WRITING TO A SEQUENTIAL FILE                                DIM00550
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------DIM00560
C DEX                                                                    DIM00570
C     SIRPAK                                                             DIM00580
C     MESOUT                                                             DIM00590
C     MENUIN                                                             DIM00600
C DEX LIBRARY                                                            DIM00610
C     UNITLF                                                             DIM00620
C     RATLDR     RSCLDR                                                  DIM00630
C     RAREDT     RSCEDT                                                  DIM00640
C     RARDMP     RSCDMP                                                  DIM00650
C MODULE                                                                 DIM00660
C     NONE                                                               DIM00670
C-----------------------------------------------------------------------DIM00680
C                                                                        DIM00690
C LABELED COMMONS                                                        DIM00700
C                                                                        DIM00710
      COMMON /DIALGF/ MTERSE                                             DIM00720
      COMMON /INOUTF/ IMODE,OMODE                                        DIM00730
      COMMON /MDNCPW/ NCPW                                               DIM00740
      COMMON /REFNOS/ RNRFIL,RNWFIL                                      DIM00750
      COMMON /LUNITS/ PSTLUN,UIOLUN                                      DIM00760
      COMMON /LINFO/ L,LENNAM,LMORGN,DEFALL                              DIM00770
      COMMON /WINFO/ W,WIDNAM,WMORGN,DEFALW                              DIM00780
      COMMON /HINFO/ H(4),HEINAM,HMORGN,NDEFH,DEFALH(4)                  DIM00790
      COMMON /DIMFRM/ LWFRM,HFRM                                         DIM00800
C                                                                        DIM00810
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                  DIM00820
C                                                                        DIM00830
      INTEGER IOFLAG,IMODE,OMODE,NCPW                                    DIM00840
      INTEGER RNRFIL,RNWFIL                                              DIM00850
      INTEGER MXIOGT,NFROM,NGOT,EFROM,NTO                                DIM00860
      INTEGER LWFRM(2),HFRM(3)                                           DIM00870
      INTEGER NAML02(1),NAML06(2),NAML12(3)                              DIM00880
      INTEGER PSTLUN,UIOLUN                                              DIM00890
      INTEGER MESS(14),LMS                                               DIM00900
      INTEGER LENNAM(2),WIDNAM(2),HEINAM(2)                              DIM00910
      INTEGER PMES(16),LMORGN(16),WMORGN(16),HMORGN(16)                  DIM00920
      INTEGER MENUDM(2),NITEMS,ITEMS(10),ITEM                            DIM00930
      INTEGER READ(2),EDIT(2),WRITE(2)                                   DIM00940
```

```
      LOGICAL MTERSE,VITAL,PMPREP
      LOGICAL LOGVAL,LMOVEC
      LOGICAL ALLFLG,LOCALL
      LOGICAL UNITLF
      LOGICAL RSCLDR,RSCEDT,RSCDMP,RAILDR,RAREDT,RARDMP
      REAL L,W,H,DEFALL,DEFALW,DEFALH
      REAL CONVLM,CONVLA
C
C VARIABLE DATA DEFINITIONS
C
      DATA MENUDM/4HDIME,4HNSIO/
      DATA NITEMS/5/
      DATA ITEMS/4HALL ,4H    ,
     1           4HLENG,4HTH  ,
     2           4HWIDT,4HH   ,
     3           4HHEIG,4HHT  ,
     4           4HDONE,4H    /
      DATA CONVLA/0.0/
      DATA LMS/14/
      DATA READ /4HREAD,4H.< /
      DATA EDIT /4HEDIT,4H.< /
      DATA WRITE/4HWRIT,4HE.< /
      DATA MXTOGT,NFROM,NGOT /4,1,4/
C
C DETERMINE THE NAMES OF THE UNITS FOR THE INPUT DIMENSIONS AND THE
C MULTIPLICAIVE CONVERSION FACTOR TO CONVERT THE INPUT UNITS TO THE
C PROGRAM STANDARD UNITS.
C
      LOGVAL=UNITLF(CONVLM,NAML02,NAML06,NAML12,ALLFLG,
     1              PSTLUN,UIOLUN,NCPW)
      IF (.NOT.LOGVAL) GO TO 99999
C
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.
C NOTE THAT IF THE LOCAL ALL OPTION IS SET IN THIS MANNER, MENU
C 'DIMENSION' IS NOT DEFINED BY THE INVOCATION OF THIS SUBROUTINE.
C
      LOCALL=ALLFLG
      IF (LOCALL) GO TO 200
C
C PREPARE A PROMPTING MESSAGE FOR MENU 'DIMENSIO'.
C
    5 CONTINUE
      IF (MTERSE) GO TO 40
      CALL STRPAK(MESS,LMS,4H<  ,33HSELECT THE DESIRED DIMENSION TO<)
      GO TO (10,20,30),IOFLAG
   10 CONTINUE
      LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,33,NCPW)
```

```
      GO TO 50
   20 CONTINUE
      LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,33,NCPW)
      GO TO 50
   30 CONTINUE
      LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,33,NCPW)
      GO TO 50
   40 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,17HWHICH DIMENSION?<)
   50 CONTINUE
      ITEM=MENUIN(MENUDM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300,400,99999),ITEM
C
C SET LOCAL ALL OPTION.
C
  100 CONTINUE
      LOCALL=.TRUE.
C
C DETERMINE WHICH OPERATION TO PERFORM ON THE LENGTH DIMENSION
C AND BRANCH ACCORDINGLY.
C
  200 CONTINUE
      GO TO (210,220,230),IOFLAG
C
C READ INPUT LENGTH.
C
  210 CONTINUE
      LOGVAL=RSCIDR(L,LOCALL,
     1              MIERSE,IMODE,NCPW,
     2              LENNAM,CONVLM,CONVLA,NAML12,.FALSE.,
     3              .TRUE.,PMES,LMORGN,
     4              RNRFIL,LWFRM,DEFALL)
      IF (LOCALL) GO TO 300
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C EDIT LENGTH.
C
  220 CONTINUE
      LOGVAL=RSCEDT(L,LOCALL,
     1              MIERSE,NCPW,
     2              LENNAM,CONVLM,CONVLA,NAML12,
     3              .TRUE.,PMES,LMORGN,
     4              RNRFIL,LWFRM,
     5              DEFALL)
      IF (LOCALL) GO TO 300
```

```
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C WRITE LENGTH.
C
  230 CONTINUL
      LOGVAL=RSCDMP(LOCALL,
     1              MTERSE,OMODE,NCPW,
     2              L,LFNNAM,CONVIM,CONVLA,NAML12,
     3              .TRUE.,PMES,LMORGN,
     4              RNWFIL,LWFRM)
      IF (LOCALL) GO TO 300
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C DETERMINE WHICH OPERATION TO PERFORM ON THE WIDTH DIMENSION AND
C BRANCH ACCORDINGLY.
C
  300 CONTINUE
      GO TO (310,320,330),IOFLAG
C
C READ WIDTH.
C
  310 CONTINUE
      LOGVAL=RSCLDR(W,LOCALL,
     1              MTERSE,IMODE,NCPW,
     2              WIDNAM,CONVIM,CONVLA,NAML12,.FALSE.,
     3              .TRUE.,PMES,WMORGN,
     4              RNRFIL,LWFRM,DEFALW)
      IF (LOCALL) GO TO 400
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C EDIT WIDTH.
C
  320 CONTINUE
      LOGVAL=RSCEDT(W,LOCALL,
     1              MTERSE,NCPW,
     2              WIDNAM,CONVLM,CONVLA,NAML12,
     3              .TRUE.,PMES,WMORGN,
     4              RNRFIL,LWFRM,
     5              DEFALW)
      IF (LOCALL) GO TO 400
      IF (.NOT.ALLFLG) GO TO 5
```

```
      ALLFLG=.FALSE.
      GO TO 99999
C
C WRITE WIDTH.
C
  330 CONTINUE
      LOGVAL=RSCDMP(LOCALL,
     1              MTERSE,OMODE,NCPW,
     2              W,WIDNAM,CONVLM,CONVLA,NAML12,
     3              .TRUE.,PMES,WMORGN,
     4              RNWFIL,LWFRM)
      IF (LOCALL) GO TO 400
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C DETERMINE WHICH OPERATION TO PERFORM ON THE HEIGHT DIMENSION
C AND BRANCH ACCORDINGLY.
C
  400 CONTINUE
      GO TO (410,420,430),IOFLAG
C
C READ HEIGHT.
C
  410 CONTINUE
      LOGVAL=RAILDR(H,LOCALL,NGOT,
     1              MTERSE,IMODE,NCPW,
     2              HEINAM,MXTOGT,CONVLM,CONVLA,NAML12,.FALSE.,
     3              .TRUE.,PMES,HMORGN,
     4              RNRFIL,HFRM,NDEFH,DEFALH)
      IF (LOCALL) GO TO 99999
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C EDIT HEIGHT.
C
  420 CONTINUE
      LOGVAL=RAREDT(H,LOCALL,
     1              MTERSE,NCPW,
     2              HEINAM,EFROM,NTO,
     3              CONVLM,CONVLA,NAML12,
     4              .TRUE.,PMES,HMORGN,
     5              RNRFIL,HFRM,
     6              NDEFH,DEFALH)
      IF (LOCALL) GO TO 99999
      IF (.NOT.ALLFLG) GO TO 5
```

```
      ALLFLG=.FALSE.                                                    DIM02830
      GO TO 99999                                                       DIM02840
C                                                                       DIM02850
C WRITE HEIGHT.                                                         DIM02860
C                                                                       DIM02870
  430 CONTINUE                                                          DIM02880
      LOGVAL=RARDMP(LOCALL,                                             DIM02890
     1              MTERSE,OMODE,NCPW,                                  DIM02900
     2              H,HEINAM,NFROM,NGOT,                                DIM02910
     3              CONVLM,CONVLA,NAML12,                               DIM02920
     4              .TRUE.,PMES,HMORGN,                                 DIM02930
     5              RNWFIL,HFRM)                                        DIM02940
      IF (LOCALL) GO TO 99999                                           DIM02950
      IF (.NOT.ALLFLG) GO TO 5                                          DIM02960
      ALLFLG=.FALSE.                                                    DIM02970
C                                                                       DIM02980
C RETURN TO CALLING PROGRAM.                                            DIM02990
C                                                                       DIM03000
99999 CONTINUE                                                          DIM03010
      RETURN                                                            DIM03020
      END                                                               DIM03030
```

```
C------------------CUBE MODULE SUBPROGRAM------------------------------
      SUBROUTINE COMPUT
C------------------SUBPROGRAM DESCRIPTION------------------------------
C     THIS SUBROUTINE CALCULATES THE VOLUME AND WEIGHT OF A CUBE OF SALT
C WATER.
C     THE STANDARD UNITS OF THIS SUBROUTINE ARE METERS AND KILOPONDS.
C-----------------LABELED COMMON VARIABLES-----------------------------
C LABELED COMMONS LINFO,WINFO,HINFO,VINFO AND WTINFO HAVE BEEN DEFINED
C IN SUBROUTINES DIMENS AND VANDWT.
C---------------------------------------------------------------------
C
C LABELED COMMONS
C
      COMMON /LINFO/ L
      COMMON /WINFO/ W
      COMMON /HINFO/ H(4)
      COMMON /VINFO/ V(4)
      COMMON /WTINFO/ WT(4)
C
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS
C
      REAL L,W,H,V,WT
      REAL RHO
C
C VARIABLE DATA DEFINITIONS
C
      DATA RHO/1023.2/
C
C CALCULATE THE VOLUME IN CUBIC METERS.
C
      DO 10 I=1,4
      V(I)=L*W*H(I)
   10 CONTINUE
C
C CALCULATE THE WEIGHT OF THE CUBE IF THE WEIGHT DENSITY OF SALT
C WATER IS 1023.2 KILOPONDS/M**3.
C
      DO 20 I=1,4
      WT(I)=V(I)*RHO
   20 CONTINUE
      RETURN
      END
```

```
C-------------------CUBE MODULE SUBPROGRAM----------------------------
      SUBROUTINE OUTPUT(CALALL,IOFLAG)
C-------------------SUBPROGRAM DESCRIPTION---------------------------
C     SUBROUTINE OUTPUT PROVIDES THE USER WITH A MENU FROM WHICH TO
C CHOOSE WHICH MODULE SEGMENT IT IS DESIRED TO OPERATE NEXT.  THE
C CHOICES ARE:
C          ALL MODULE OUTPUT VARIABLES
C          THE MODULE UNITS TO BE USED DURING INPUT AND OUTPUT
C          THE MODULE RESULTS
C     THE UNITS MODULE ALLOWS THE USER TO SPECIFY THE LENGTH AND FORCE
C UNITS TO BE USED DURING INPUT AND OUTPUT.  THE RESULTS MODULE
C ALLOWS THE USER TO READ, EDIT OR WRITE THE CUBE VOLUME AND WEIGHT.
C     IF THE CALLING PROGRAM ALL OPTION IS ACTIVE, THE LOCAL ALL
C OPTION IS SET TO .TRUE. UPON INVOKING THIS SUBROUTINE.  IN THIS CASE
C MENU 'OUTPUT' IS NOT DEFINED.
C-------------------SUBPROGRAM ASSUMPTIONS-------------------------------
C THE UNITS MODULE SHOULD BE ACCESSED IF EITHER UIOLUN OR UIOFUN,
C WHICH ARE USED TO FIND THE VOLUME AND WEIGHT UNITS RESPECTIVELY, ARE
C TO BE DIFFERENT FROM THAT WHICH WAS ESTABLISHED BY EITHER THE BLOCK
C DATA SUBPROGRAM OR DURING THE INPUT SEQUENCE.
C-------------------OUTPUT VARIABLES-------------------------------------
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR
C                 OCCURRED WHEN READING OR EDITING AN OUTPUT VARIABLE
C        .FALSE.  IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR
C                 OCCURRED WHEN READING OR EDITING AN OUTPUT VARIABLE
C-------------------INPUT VARIABLES--------------------------------------
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE
C        .FALSE.  THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE
C IOFLAG=1 IF THE USER WISHES TO READ THE VARIABLES
C        2                        EDIT
C        3                        WRITE
C----------------------LABELED COMMON VARIABLES-------------------------
C LABELED COMMON DIALGF AND MDNCPW HAVE BEEN DEFINED IN SUBROUTINE
C MAINPG.
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------
C DEX
C     STRPAK
C     LMOVEC
C     MENUIN
C DEX LIBRARY
C     NONE
C MODULE
C     MXUNIT
C     VANDWT
C----------------------------------------------------------------------
C
C LABELED COMMONS
C
      COMMON /DIALGF/ MTERSE
```

```
      COMMON /MDNCPW/ NCPW                                              OUT00500
C                                                                       OUT00510
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                  OUT00520
C                                                                       OUT00530
      INTEGER IOFLAG                                                    OUT00540
      INTEGER MENUNM(2),NITEMS,ITEMS(8),ITEM                            OUT00550
      INTEGER MESS(16),LMS,NCPW                                         OUT00560
      INTEGER READ(2),EDIT(2),WRITE(2)                                  OUT00570
      LOGICAL CALALL,LOCALL                                             OUT00580
      LOGICAL MTERSE,LOGVAL,LMOVEC                                      OUT00590
C                                                                       OUT00600
C VARIABLE DATA DEFINITIONS                                             OUT00610
C                                                                       OUT00620
      DATA LMS/16/                                                      OUT00630
      DATA MENUNM/4HOUTP,4HUT  /                                        OUT00640
      DATA NITEMS/4/                                                    OUT00650
      DATA ITEMS/4HALL ,4H    ,                                         OUT00660
     1           4HUNIT,4HS   ,                                         OUT00670
     2           4HRESU,4HLTS ,                                         OUT00680
     3           4HDONE,4H    /                                         OUT00690
      DATA LOCALL/.FALSE./                                              OUT00700
      DATA READ /4HREAD,4H.<  /                                        OUT00710
      DATA EDIT /4HEDIT,4H.<  /                                        OUT00720
      DATA WRITE/4HWRIT,4HE.< /                                        OUT00730
C                                                                       OUT00740
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.     OUT00750
C NOTE THAT IF THE LOCAL ALL OPTION IS SET IN THIS MANNER, MENU         OUT00760
C 'OUTPUT' WILL NOT BE DEFINED BY THE INVOCATION OF THIS SUBROUTINE.    OUT00770
C                                                                       OUT00780
      LOCALL=CALALL                                                     OUT00790
      IF (LOCALL) GO TO 200                                             OUT00800
C                                                                       OUT00810
C PREPARE A PROMPTING MESSAGE FOR MENU 'OUTPUT' AND THEN PROVIDE THE    OUT00820
C MENU TO THE USER.                                                     OUT00830
C                                                                       OUT00840
    5 CONTINUE                                                          OUT00850
      CALL STRPAK(MESS,LMS,4H<   ,41HSELECT WHICH OUTPUT VARIABLE SEGMENOUT00860
     1T TO<)                                                           OUT00870
      GO TO (10,20,30),IOFLAG                                           OUT00880
   10 LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,41,NCPW)                         OUT00890
      GO TO 50                                                          OUT00900
   20 LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,41,NCPW)                         OUT00910
      GO TO 50                                                          OUT00920
   30 LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,41,NCPW)                        OUT00930
   50 CONTINUE                                                          OUT00940
      ITEM=MENUIN(MENUNM,NITEMS,ITEMS,MESS)                             OUT00950
      GO TO (100,200,300,400),ITEM                                      OUT00960
C                                                                       OUT00970
C SET THE OUTPUT ALL OPTION.                                            OUT00980
```

```
C
  100 CONTINUE
      LOCALL=.TRUE.
C
C READ, EDIT OR WRITE THE INPUT/OUTPUT MODULE UNITS.
C
  200 CONTINUE
      CALL MXUNIT(LOCALL,IOFLAG)
      IF (LOCALL) GO TO 300
      IF (.NOT.CALALL) GO TO 50
      CALALL=.FALSE.
      GO TO 400
C
C CALL VANDWT TO READ, EDIT OR WRITE THE CUBE VOLUME AND WEIGHT.
C
  300 CONTINUE
      CALL VANDWT(LOCALL,IOFLAG)
      IF (LOCALL) GO TO 400
      IF (.NOT.CALALL) GO TO 50
      CALALL=.FALSE.
C
C RETURN CONTROL TO CALLING PROGRAM.
C
  400 CONTINUE
      RETURN
      END
```

```
C-------------------CUBE MODULE SUBPROGRAM---------------------------
      SUBROUTINE VANDWT(ALLFLG,IOFLAG)
C-------------------SUBPROGRAM DESCRIPTION--------------------------
C     SUBROUTINE VANDWT FIRST CALLS UNITLF, UNITFF AND UVOL TO OBTAIN THE
C MULTIPLICATIVE LENGTH, FORCE (WEIGHT) AND VOLUME CONVERSION FACTORS
C AND THE NAMES OF THE FORCE AND VOLUME UNITS TO BE USED DURING OUTPUT.
C     VANDWT THEN PROVIDES A MENU FROM WHICH THE USER SELECTS WHICH
C PROGRAM COMPUTATION RESULTS IT IS DESIRED TO READ, EDIT OR WRITE.
C THE CHOICES ARE:
C             ALL RESULTS
C             VOLUME
C             WEIGHT
C VANDWT THEN CALLS RA1LDR, RAREDT, OR RARDMP AS NECESSARY FOR EACH
C VARIABLE.
C     IF THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE, THE LOCALL ALL
C OPTION IS SET TO .TRUE. IMMEDIATELY AFTER THE UNITS INFORMATION IS
C OBTAINED.  IN THIS CASE, MENU 'RESULTS' IS NOT INVOKED.
C-------------------SUBPROGRAM ASSUMPTIONS------------------------------
C NONE YET
C-------------------OUTPUT VARIABLES------------------------------------
C ALLFLG: .TRUE.  IF THE INPUT VALUE OF ALLFLG WAS .TRUE. AND NO ERROR
C                 OCCURED WHEN READING ANY UNIT OR EDITING ANY PROGRAM
C                 RESULT
C         .FALSE. IF THE INPUT VALUE OF ALLFLG WAS .FALSE. OR AN ERROR
C                 OCCURED WHEN READING A UNIT OR EDITING A PROGRAM
C                 RESULT
C-------------------INPUT VARIABLES-------------------------------------
C ALLFLG: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE
C       : .FALSE. THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE
C IOFLAG=1 IF THE USER WISHES TO INVOKE RA1LDR
C        2                              RAREDT
C        3                              RARDMP
C--------------------LABELED COMMON VARIABLES-------------------------
C LABELED COMMONS DIALGF,INOUTF,MDNCPW AND REFNOS HAVE BEEN DEFINED
C IN SUBROUTINE MAINPG.  LABELED COMMONS LUNITS AND FUNITS HAVE BEEN
C DEFINED IN SUBROUTINE MXUNIT.
C......VINIO INITIALIZED IN BLOCK DATA
C V     : VOLUME OF THE CUBE IN PROGRAM STANDARD UNITS
C VOLNAM: DATABASE NAME FOR VOLUME
C VMORGN: COMMENT DESCRIBING VOLUME
C NDEFV : THE NUMBER OF VOLUME DEFAULT VALUES
C DEFALV: THE DEFAULT VALUES FOR VOLUME
C......WTINFO INITIALIZED IN BLOCK DATA
C WT    : WEIGHT OF THE CUBE IN PROGRAM STANDARD UNITS
C WEINAM: DATABASE NAME FOR WEIGHT
C WTMRGN: COMMENT DESCRIBING WEIGHT
C NDEFWT: THE NUMBER OF WEIGHT DEFAULT VALUES
C DFALWT: THE DEFAULT VALUES FOR WEIGHT
C......ANSIRM INITIALIZED IN BLOCK DATA
```

```
C ANSFRM: FORMAT TO BE USED FOR THE CUBE PROPERTIES WHEN READING FROM   VAN00500
C         OR WRITING TO A SEQUENTIAL FILE                                VAN00510
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------VAN00520
C DEX                                                                    VAN00530
C     STRPAK                                                             VAN00540
C     IMOVEC                                                             VAN00550
C     MISOUT                                                             VAN00560
C     MENUIN                                                             VAN00570
C DEX LIBRARY                                                            VAN00580
C     UNITLF                                                             VAN00590
C     UNITFF                                                             VAN00600
C     UVOL                                                               VAN00610
C     RATEDR                                                             VAN00620
C     RAREDI                                                             VAN00630
C     RARDMP                                                             VAN00640
C MODULE                                                                 VAN00650
C     NONE                                                               VAN00660
C-----------------------------------------------------------------------VAN00670
C                                                                        VAN00680
C LABELED COMMONS                                                        VAN00690
C                                                                        VAN00700
      COMMON /DIALGF/ MTERSE                                             VAN00710
      COMMON /INOUTF/ IMODE,OMODE                                        VAN00720
      COMMON /MDNCPW/ NCPW                                               VAN00730
      COMMON /REFNOS/ RNRFIL,RNWFIL                                      VAN00740
      COMMON /LUNITS/ PSTLUN,UIOLUN                                      VAN00750
      COMMON /FUNITS/ PSTFUN,UIOFUN                                      VAN00760
      COMMON /VINFO/  V(4),VOLNAM,VMORGN,NDEFV,DEFALV(4)                 VAN00770
      COMMON /WTINFO/ WT(4),WEINAM,WTMRGN,NDEFWT,DFALWT(4)               VAN00780
      COMMON /ANSFRM/ ANSFRM                                             VAN00790
C                                                                        VAN00800
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                  VAN00810
C                                                                        VAN00820
      INTEGER IOFLAG,IMODE,OMODE,NCPW                                    VAN00830
      INTEGER RNRFIL,RNWFIL                                              VAN00840
      INTEGER ANSFRM(3)                                                  VAN00850
      INTEGER NAML02(1),NAML06(2),NAML12(3)                              VAN00860
      INTEGER NAMF02(1),NAMF03(1),NAMF12(3)                              VAN00870
      INTEGER UNVOL(3)                                                   VAN00880
      INTEGER PSTLUN,UIOLUN                                              VAN00890
      INTEGER PSTFUN,UIOFUN                                              VAN00900
      INTEGER MESS(13),LMS                                               VAN00910
      INTEGER VOLNAM(2),WEINAM(2)                                        VAN00920
      INTEGER PMES(16),VMORGN(16),WTMRGN(16)                             VAN00930
      INTEGER NDEFV,NDEFWT                                               VAN00940
      INTEGER MENURL(2),NITEMS,ITEMS(8),ITEM                             VAN00950
      INTEGER READ(2),EDIT(2),WRITE(2)                                   VAN00960
      INTEGER MXTOGI,NTROM,NTO                                           VAN00970
      INTEGER VGOT,WTGOT,FROM                                            VAN00980
```

```
      LOGICAL MTERSE,VITAL,PMPREP                                       VAN00990
      LOGICAL LOGVAL,LMOVEC                                             VAN01000
      LOGICAL ALLFLG,LOCALL                                             VAN01010
      LOGICAL UNITLF,UNITFF,UVOL                                        VAN01020
      LOGICAL RATLDR,RAREDT,RARDMP                                      VAN01030
      REAL V,WT,DEFALV,DFALWT                                           VAN01040
      REAL CONVLM,CONVLA                                                VAN01050
      REAL CONVFM,CONVFA                                                VAN01060
      REAL CNVFVM,CNVFVA                                                VAN01070
C                                                                       VAN01080
C VARIABLE DATA DEFINITIONS                                             VAN01090
C                                                                       VAN01100
      DATA MENURL/4HRESU,4HLTS /                                        VAN01110
      DATA NITEMS/4/                                                    VAN01120
      DATA ITEMS/4HALL ,4H    ,                                         VAN01130
     1           4HVOLU,4HME  ,                                         VAN01140
     2           4HWEIG,4HHT  ,                                         VAN01150
     3           4HDONE,4H    /                                         VAN01160
      DATA CONVLA/0.0/                                                  VAN01170
      DATA CONVFA/0.0/                                                  VAN01180
      DATA CNVFVA/0.0/                                                  VAN01190
      DATA LMS/13/                                                      VAN01200
      DATA READ /4HREAD,4H.<  /                                        VAN01210
      DATA EDIT /4HEDIT,4H.<  /                                        VAN01220
      DATA WRITE/4HWRIT,4HE.< /                                        VAN01230
      DATA MXTOGT,VGOT,WTGOT,FROM /4,4,4,1/                             VAN01240
C                                                                       VAN01250
C DETERMINE THE NAMES OF THE UNITS FOR THE OUTPUT RESULTS AND THE       VAN01260
C MULTIPLICATIVE CONVERSION FACTORS TO CONVERT THE RESULTS IN PROGRAM   VAN01270
C STANDARD UNITS TO OUTPUT UNITS.                                       VAN01280
C                                                                       VAN01290
      LOGVAL=UNITLF(CONVLM,NAML02,NAML06,NAML12,ALLFLG,                 VAN01300
     1              PSTLUN,UIOLUN,NCPW)                                 VAN01310
      IF (.NOT.LOGVAL) GO TO 99999                                      VAN01320
      LOGVAL=UVOL(CNVFVM,UNVOL,ALLFLG,                                  VAN01330
     1            CONVLM,NAML06,NCPW)                                   VAN01340
      IF (.NOT.LOGVAL) GO TO 99999                                      VAN01350
      LOGVAL=UNITFF(CONVFM,NAMF02,NAMF03,NAMF12,ALLFLG,                 VAN01360
     1              PSTFUN,UIOFUN,NCPW)                                 VAN01370
      IF (.NOT.LOGVAL) GO TO 99999                                      VAN01380
C                                                                       VAN01390
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.     VAN01400
C NOTE THAT IS THE LOCAL ALL OPTION IS SET IN THIS MANNER, MENU         VAN01410
C 'RESULTS' WILL NOT BE DEFINED BY THE INVOCATION OF THIS SUBROUTINE.   VAN01420
C                                                                       VAN01430
      LOCALL=ALLFLG                                                     VAN01440
      IF (LOCALL) GO TO 200                                             VAN01450
C                                                                       VAN01460
C PREPARE A PROMPTING MESSAGE FOR MENU 'RESULTS'.                       VAN01470
```

```
C                                                                       VANO1480
    5 CONTINUE                                                          VANO1490
      IF (MTERSE) GO TO 40                                              VANO1500
      CALL STRPAK(MESS,LMS,4H<   ,30HSELECT THE DESIRED RESULT TO<)    VANO1510
      GO TO (10,20,30),IOFLAG                                           VANO1520
   10 CONTINUE                                                          VANO1530
      LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,30,NCPW)                         VANO1540
      GO TO 50                                                          VANO1550
   20 CONTINUE                                                          VANO1560
      LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,30,NCPW)                         VANO1570
      GO TO 50                                                          VANO1580
   30 CONTINUE                                                          VANO1590
      LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,30,NCPW)                        VANO1600
      GO TO 50                                                          VANO1610
   40 CONTINUE                                                          VANO1620
      CALL STRPAK(MESS,LMS,4H<   ,14HWHICH RESULT?<)                   VANO1630
   50 CONTINUE                                                          VANO1640
      ITEM MENUIN(MENURL,NITEMS,ITEMS,MESS)                             VANO1650
      GO TO (100,200,300,99999),ITEM                                    VANO1660
C                                                                       VANO1670
C SET LOCAL ALL OPTION.                                                 VANO1680
C                                                                       VANO1690
  100 CONTINUE                                                          VANO1700
      LOCALL=.TRUE.                                                     VANO1710
C                                                                       VANO1720
C DETERMINE WHICH OPERATION TO PERFORM ON THE VOLUME VALUE AND          VANO1730
C BRANCH ACCORDINGLY.                                                   VANO1740
C                                                                       VANO1750
  200 CONTINUE                                                          VANO1760
      GO TO (210,220,230),IOFLAG                                        VANO1770
C                                                                       VANO1780
C READ VOLUME.                                                          VANO1790
C                                                                       VANO1800
  210 CONTINUE                                                          VANO1810
      LOGVAL=RAILDR(V,LOCALL,VGOT,                                      VANO1820
     1              MTERSE,IMODE,NCPW,                                  VANO1830
     2              VOLNAM,MXTOGT,CNVFVM,CNVFVA,UNVOL,.FALSE.,          VANO1840
     3              .TRUE.,PMES,VMORGN,                                 VANO1850
     4              RNRFIL,ANSFRM,                                      VANO1860
     5              NDEFV,DEFALV)                                       VANO1870
      IF (LOCALL) GO TO 300                                             VANO1880
      IF (.NOT.ALLFLG) GO TO 5                                          VANO1890
      ALLFLG=.FALSE.                                                    VANO1900
      GO TO 99999                                                       VANO1910
C                                                                       VANO1920
C EDIT VOLUME.                                                          VANO1930
C                                                                       VANO1940
  220 CONTINUE                                                          VANO1950
      LOGVAL=RAREDT(V,LOCALL,                                           VANO1960
```

```
     1                MIERSE,NCPW,
     2                VOLNAM,NFROM,NTO,
     3                CNVFVM,CNVFVA,UNVOL,
     4                .TRUE.,PMES,VMORGN,
     5                RNRFIL,ANSFRM,
     6                NDEFV,DEFALV)
      IF (LOCALL) GO TO 300
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C WRITE VOLUME.
C
  230 CONTINUE
      LOGVAL=RARDMP(LOCALL,
     1                MIERSE,OMODI,NCPW,
     2                V,VOLNAM,FROM,VGOT,
     3                CNVFVM,CNVFVA,UNVOL,
     4                .TRUE.,PMES,VMORGN,
     5                RNWFIL,ANSFRM)
      IF (LOCALL) GO TO 300
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C DETERMINE WHICH OPERATION TO PERFORM ON THE WEIGHT VALUE AND
C BRANCH ACCORDINGLY.
C
  300 CONTINUE
      GO TO (310,320,330),IOFLAG
C
C READ WEIGHT.
C
  310 CONTINUE
      LOGVAL=RA1LDR(WT,LOCALL,WTGOT,
     1                MIERSE,IMODE,NCPW,
     2                WEINAM,MXTOGT,CONVFM,CONVFA,NAMF12,.FALSE.,
     3                .TRUE.,PMES,WTMRGN,
     4                RNRFIL,ANSFRM,
     5                NDEFWT,DFALWT)
      IF (LOCALL) GO TO 99999
      IF (.NOT.ALLFLG) GO TO 5
      ALLFLG=.FALSE.
      GO TO 99999
C
C EDIT WEIGHT.
C
  320 CONTINUE
      LOGVAL=RAREDT(WT,LOCALL,
```

```
     1                MIERSE,NCPW,                                            VAN02460
     2                WEINAM,NFROM,NTO,                                       VAN02470
     3                CONVFM,CONVFA,NAMF12,                                   VAN02480
     4                .TRUE.,PMES,WIMRGN,                                     VAN02490
     5                RNRFIL,ANSFRM,                                          VAN02500
     6                NDEFWT,DFALWT)                                          VAN02510
      IF (LOCALL) GO TO 99999                                                 VAN02520
      IF (.NOT.ALLFLG) GO TO 5                                                VAN02530
      ALLFLG=.FALSE.                                                          VAN02540
      GO TO 99999                                                             VAN02550
C                                                                             VAN02560
C WRITE WEIGHT.                                                               VAN02570
C                                                                             VAN02580
  330 CONTINUE                                                                VAN02590
      LOGVAL=RARDMP(LOCALL,                                                   VAN02600
     1                MIERSE,OMODE,NCPW,                                      VAN02610
     2                WT,WEINAM,FROM,WTGOT,                                   VAN02620
     3                CONVFM,CONVFA,NAMF12,                                   VAN02630
     4                .TRUE.,PMES,WIMRGN,                                     VAN02640
     5                RNWFIL,ANSFRM)                                          VAN02650
      IF (LOCALL) GO TO 99999                                                 VAN02660
      IF (.NOT.ALLFLG) GO TO 5                                                VAN02670
      ALLFLG=.FALSE.                                                          VAN02680
C                                                                             VAN02690
C RETURN TO CALLING PROGRAM.                                                  VAN02700
C                                                                             VAN02710
99999 CONTINUE                                                                VAN02720
      RETURN                                                                  VAN02730
      END                                                                     VAN02740
```

```
C---------------------CUBE MODULE SUBPROGRAM----------------------------
      BLOCK DATA
C-------------------SUBPROGRAM DESCRIPTION------------------------------
C THIS SUBPROGRAM INITIALIZES VARIABLES IN THE LABELED COMMON BLOCKS OF
C THIS MODULE.
C EACH LABELED COMMON AND ALL RELATED STATEMENTS AND DEFINITIONS ARE
C LISTED UNDER THE SUBPROGRAM NAME WHERE THE LABELED COMMON FIRST
C APPEARS.
C-----------------PROGRAMMERS AND REPORT--------------------------------
C PROGRAM VERSION: 1
C PROGRAM DATE    : JUNE 1981
C PROGRAMMERS     : C. CHRYSSOSTOMIDIS AND R. CELOTTO
C REPORT          : IDEAS ON HOW TO WRITE DEX MODULES
C                 : VOLUME AND WEIGHT OF A S.W. PARALLELPIPED
C                 : CUBE MODULE ROUTINES
C REPORT NUMBER   : 81-1
C AUTHORS         : C. CHRYSSOSTIMIDIS AND R. CELOTTO
C PUBLISHER       : MASSACHUSETTS INSTITUTE OF TECHNOLOGY
C                   DEPARTMENT OF OCEAN ENGINEERING
C                   DESIGN LABORATORY
C                   CAMBRIDGE MASS 02139, JUNE 1981
C----------------------------------------------------------------------
C...................SUBROUTINE MAINPG..................................
      COMMON/REFNOS/RNRFIL,RNWFIL
      COMMON/INOUTF/IMODE,OMODE
      COMMON/DIALGF/MTERSE
      COMMON/MDNCPW/NCPW
      INTEGER RNRFIL,RNWFIL
      INTEGER IMODE,OMODE
      INTEGER NCPW
      LOGICAL MTERSE
      DATA RNRFIL/3/
      DATA RNWFIL/4/
      DATA IMODE /2/
      DATA OMODE /2/
      DATA MTERSE/.FALSE./
C**** START OF SITE DEPENDENT CODE
      DATA NCPW  /4/
C**** END   OF SITE DEPENDENT CODE
C...................SUBROUTINE LUNIT...................................
      COMMON /LUNITS/ PSTLUN,UIOLUN
      COMMON /LUINFO/ DBLUNN,DBLUNC,LUNFRM,DEFLUN
      INTEGER PSTLUN,UIOLUN
      INTEGER DBLUNN(2),DBLUNC(16),LUNFRM(2),DEFLUN
      DATA PSTLUN/7/
      DATA UIOLUN/7/
      DATA DBLUNN/4HUIOL,4HUN  /
      DATA DBLUNC/4HLENG,4HTH U,4HNIT ,4HTO B,
     1           4HE US,4HED D,4HURIN,4HG IN,
```

```
     2            4HPUT ,4HOUTP,4HUTK ,4H    ,                          BL000500
     3            4H    ,4H    ,4H    ,4H    /                          BL000510
      DATA LUNFRM/4H(I10,4H)   /                                        BL000520
      DATA DEFLUN/7/                                                    BL000530
C..................SUBROUTINE TUNIT.............................         BL000540
      COMMON /TUNITS/ PSTTUN,UIOTUN                                     BL000550
      COMMON /TUINFO/ DBTUNN,DBTUNC,TUNFRM,DEFTUN                       BL000560
      INTEGER PSTTUN,UIOTUN                                             BL000570
      INTEGER DBTUNN(2),DBTUNC(16),TUNFRM(2),DEFTUN                     BL000580
      DATA PSTTUN/1/                                                    BL000590
      DATA UIOTUN/1/                                                    BL000600
      DATA DBTUNN/4HUIOT,4HUN  /                                        BL000610
      DATA DBTUNC/4HTIME,4H   U,4HNIT ,4HTO B,                          BL000620
     1            4HE US,4HED D,4HURIN,4HG IN,                          BL000630
     2            4HPUT ,4HOUTP,4HUTK ,4H    ,                          BL000640
     3            4H    ,4H    ,4H    ,4H    /                          BL000650
      DATA TUNFRM/4H(I10,4H)   /                                        BL000660
      DATA DEFTUN/1/                                                    BL000670
C..................SUBROUTINE FUNIT.................................     BL000680
      COMMON /FUNITS/ PSTFUN,UIOFUN                                     BL000690
      COMMON /FUINFO/ DBFUNN,DBFUNC,FUNFRM,DEFFUN                       BL000700
      INTEGER PSTFUN,UIOFUN                                             BL000710
      INTEGER DBFUNN(2),DBFUNC(16),FUNFRM(2),DEFFUN                     BL000720
      DATA PSTFUN/7/                                                    BL000730
      DATA UIOFUN/7/                                                    BL000740
      DATA DBFUNN/4HUIOF,4HUN  /                                        BL000750
      DATA DBFUNC/4HFORC,4HE  U,4HNIT ,4HTO B,                          BL000760
     1            4HE US,4HED D,4HURIN,4HG IN,                          BL000770
     2            4HPUT ,4HOUTP,4HUTK ,4H    ,                          BL000780
     3            4H    ,4H    ,4H    ,4H    /                          BL000790
      DATA FUNFRM/4H(I10,4H)   /                                        BL000800
      DATA DEFFUN/7/                                                    BL000810
C.......................SUBROUTINE AUNIT..........................       BL000820
      COMMON /AUNITS/ PSTAUN,UIOAUN                                     BL000830
      COMMON /AUINFO/ DBAUNN,DBAUNC,AUNFRM,DEFAUN                       BL000840
      INTEGER PSTAUN,UIOAUN                                             BL000850
      INTEGER DBAUNN(2),DBAUNC(16),AUNFRM(2),DEFAUN                     BL000860
      DATA PSTAUN/1/                                                    BL000870
      DATA UIOAUN/1/                                                    BL000880
      DATA DBAUNN/4HUIOA,4HUN  /                                        BL000890
      DATA DBAUNC/4HANGL,4HE  U,4HNIT ,4HTO B,                          BL000900
     1            4HE US,4HED D,4HURIN,4HG IN,                          BL000910
     2            4HPUT ,4HOUTP,4HUTK ,4H    ,                          BL000920
     3            4H    ,4H    ,4H    ,4H    /                          BL000930
      DATA AUNFRM/4H(I10,4H)   /                                        BL000940
      DATA DEFAUN/1/                                                    BL000950
C.......................SUBROUTINE TPUNIT..........................      BL000960
      COMMON /TPUNTS/ PSTPUN,UIOTPU                                     BL000970
      COMMON /TPINFO/ DBTPUN,DBTPUC,TPUFRM,DEFTPU                       BL000980
```

```
      INTEGER PSTPUN,UIOTPU
      INTEGER DBTPUN(2),DBTPUC(16),TPUFRM(2),DEFTPU
      DATA PSTPUN/1/
      DATA UIOTPU/1/
      DATA DBTPUN/4HUIOT,4HPU  /
      DATA DBTPUC/4HTEMP,4HERAT,4HURE ,4HUNIT,
     1            4H TO ,4HBE U,4HSED ,4HDURI,
     2            4HNG I,4HNPUT,4H OUT,4HPUT<
     3            4H    ,4H    ,4H    ,4H    /
      DATA TPUFRM/4H(I10,4H)    /
      DATA DEFTPU/1/
C.....................SUBROUTINE DIMENS..............................
      COMMON /LINFO/ L,LENNAM,LMORGN,DEFALL
      COMMON /WINFO/ W,WIDNAM,WMORGN,DEFALW
      COMMON /HINFO/ H(4),HEINAM,HMORGN,NDEFH,DEFALH(4)
      COMMON /DIMFRM/ LWFRM,HFRM
      INTEGER LENNAM(2),WIDNAM(2),HEINAM(2)
      INTEGER LMORGN(16),WMORGN(16),HMORGN(16)
      INTEGER LWFRM(2),HFRM(3),NDEFH
      RLAL L,W,H,DEFALL,DEFALW,DEFALH
      DATA L,W,H(1),H(2),H(3),H(4) /1.0,1.0,1.0,2.0,3.0,4.0/
      DATA LENNAM/4HLENG,4HTH  /
      DATA LMORGN/4HLENG,4HTH O,4HF CU,4HBE (,4H????,4H????,4H????,
     1            4H)< ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA WIDNAM/4HWIDT,4HH   /
      DATA WMORGN/4HWIDT,4HH OF,4H CUB,4HE (?,4H????,4H????,4H???),
     1            4H<  ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA HEINAM/4HHEIG,4HHT  /
      DATA HMORGN/4HHEIG,4HHT O,4HF CU,4HBE (,4H????,4H????,4H????,
     1            4H)< ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA NDEFH/4/
      DATA DEFALL,DEFALW,DEFALH(1),DEFALH(2),DEFALH(3),DEFALH(4)
     1           /1.1,2.2,1.,2.,3.,4./
      DATA LWFRM/4H(E13,4H.6) /
      DATA HFRM /4H(I10,4H/4E1,4H3.6)/
C.....................SUBROUTINE VANDWT..............................
      COMMON /VINFO/ V(4),VOLNAM,VMORGN,NDEFV,DEFALV(4)
      COMMON /WTINFO/ WT(4),WEINAM,WTMRGN,NDEFWT,DFALWT(4)
      COMMON /ANSFRM/ ANSFRM
      INTEGER VOLNAM(2),WEINAM(2)
      INTEGER VMORGN(16),WTMRGN(16)
      INTEGER NDEFV,NDEFWT
      INTEGER ANSFRM(3)
      REAL V,WT,DEFALV,DFALWT
      DATA V(1),V(2),V(3),V(4)  /1.0,2.0,3.0,4.0/
      DATA WT(1),WT(2),WT(3),WT(4)  /1023.2,2046.4,3069.6,4092.8/
```

```
      DATA VOLNAM/4HVOLU,4HME  /                                        BL001480
      DATA VMORGN/4HVOLU,4HME 0,4HF CU,4HBE (,4H????,4H????,4H????,     BL001490
     1            4H)X  ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,    BL001500
     2            4H    ,4H    /                                        BL001510
      DATA WEINAM/4HWEIG,4HHT  /                                        BL001520
      DATA WTMRGN/4HWEIG,4HHT 0,4HF CU,4HBE (,4H????,4H????,4H????,     BL001530
     1            4H)<  ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,    BL001540
     2            4H    ,4H    /                                        BL001550
      DATA NDEFV,NDEFWT/4,4/                                            BL001560
      DATA DEFALV(1),DEFALV(2),DEFALV(3),DEFALV(4)                      BL001570
     1           /2.42,4.84,7.26,9.68/                                  BL001580
      DATA DFALWT(1),DFALWT(2),DFALWT(3),DFALWT(4)                      BL001590
     1           /2476.1,4952.3,7428.4,9904.6/                          BL001600
      DATA ANSFRM/4H(I10,4H/4E1,4H3.6)/                                 BL001610
      END                                                               BL001620
```

APPENDIX B

UNIT SUBROUTINE ABBREVIATIONS AND CALLING SEQUENCES

Table B-1. Angle Unit Abbreviations

NAMA03	NAMA06	NAMA08	NAMA12
CYC	CYCLE	CYCLE	CYCLE
RAD	RADIAN	RADIAN	RADIAN
DEG	DEGREE	DEG(ANG)	DEGREE(ANG)
MIN	MINUTE	MIN(ANG)	MINUTE(ANG)
SEC	SECOND	SEC(ANG)	SECOND(ANG)

Table B-2. Force Unit Abbreviations

NAMF02	NAMF03	NAMF12
PL	PDL	POUNDAL
LB	LBF	POUND(FORCE)
ST	ST	SHORT TON
LT	LT	LONG TON
DY	DYN	DYNE
N	N	NEWTON
KP	KGF	KILOPOND

Table B-3. Length Unit Abbreviations

NAML02	NAML06	NAML12
IN	INCH	INCH
FT	FOOT	FOOT
SM	STATMI	STATUTE MILE
NM	NAUTMI	NAUT. MILE
MM	MILLIM	MILLIMETER
CM	CENTIM	CENTIMETER
MT	METER	METER
KM	KILOMT	KILOMETER

Table B-4. Temperature Unit Abbreviations

NAMTP1	NAMTP5	NMTP12
C	DEG-C	DEGREES-C
F	DEG-F	DEGREES-F
K	DEG-K	DEGREES-K
R	DEG-R	DEGREES-R

Table B-5. Time Unit Abbreviations

NAMT02	NAMT03	NAMT06	NAMT12
SC	SEC	SECOND	SECOND
MN	MIN	MINUTE	MINUTE
HR	HR	HOUR	HOUR
DY	DAY	DAY	DAY
WK	WK	WEEK	WEEK
MO	MO	MONTH	MONTH
YR	YR	YEAR	YEAR

Table B-6. Calling Sequences of Derived Units

```
LOGICAL FUNCTION UAACC(UFAACC,UNAACC,ALLFLG,
                       CONVA,CONVT,NAMA03,NAMT03,NCPW)

LOGICAL FUNCTION UACCEL(UFACC,UNACC,ALLFLG,
                        CONVL,CONVT,NAML06,NAMT02,NCPW)

LOGICAL FUNCTION UAREA(UFAREA,UNAREA,ALLFLG,
                       CONVL,NAML06,NCPW)

LOGICAL FUNCTION UFREQ(UFFREQ,UNFREQ,ALLFLG,
                       CONVA,CONVT,NAMA08,NAMT03,
                       UIOAUN,UIOTUN,NCPW)

LOGICAL FUNCTION UKVISC(UFKVIS,UNKVIS,ALLFLG,
                        CONVL,CONVT,NAML02,NAMT03,
                        UIOLUN,UIOTUN,NCPW)

LOGICAL FUNCTION UMASS(UFMASS,UNMASS,ALLFLG,
                       CONVF,CONVL,CONVT,NAMF02,NAML02,
                       NAMT02,UIOFUN,UIOLUN,UIOTUN,NCPW)

LOGICAL FUNCTION UMPOWR(UFPOWE,UNPOWE,ALLFLG,
                        CONVF,CONVL,CONVT,NAMF02,NAML02,
                        NAMT02,UIOFUN,UIOLUN,UIOTUN,NCPW)

LOGICAL FUNCTION UPRESS(UFPRES,UNPRES,ALLFLG,
                        CONVF,CONVL,NAMF03,NAML02,NCPW)

LOGICAL FUNCTION UPSPEC(UFPSPE,UNPSPE,ALLFLG,
                        CONVL,CONVT,NAML02,NAMT03,NCPW)

LOGICAL FUNCTION URHO(UFRHO,UNRHO,ALLFLG,
                      CONVF,CONVL,CONVT,NAMF03,NAML02,
                      NAMT02,UIOFUN,UIOLUN,UIOTUN,NCPW)

LOGICAL FUNCTION USPEED(UFSPEE,UNSPEE,ALLFLG,
                        CONVL,CONVT,NAML06,NAMT02,
                        UIOLUN,UIOTUN,NCPW)

LOGICAL FUNCTION UVOL(UFVOL,UNVOL,ALLFLG,
                      CONVL,NAML06,NCPW)
```

APPENDIX C

SAMPLE GENERAL DATABASE

Note: This is an edited version of the listing of the database obtained at the terminal. The actual listing of the items is in a random order due to the hashing function employed during the storing of the entries. Group headings also would not appear at the terminal.

```
$TITLE:  **   GENERAL DATABASE FOR U.S. DDG-2 'CHARLES F. ADAMS' CLASS   **

$  NAME     TYPE           VALUE  COMMENT

                      HULL CHARACTERISTICS

   LOA      (R)     0.43700E+03  LENGTH OVERALL (FOOT          )
   LBP      (R)     0.42000E+03  LENGTH BETWEEN PERPENDICULARS (FOOT          )
   BEAMDWL  (R)     0.46000E+02  MOLDED BEAM AT DESIGN WATERLINE (FOOT          )
   BEAMMAX  (R)     0.47000E+02  MAXIMUM BEAM (FOOT          )
   T        (R)     0.15100E+02  MOLDED DRAFT TO KEEL (FOOT          )
   CP       (R)   **UNDEFINED**  PRISMATIC COEFFICIENT
   CX       (R)   **UNDEFINED**  MIDSHIP COEFFICIENT
   CB       (R)     0.53100E+00  BLOCK COEFFICIENT
   CWP      (R)     0.78200E+00  WATERPLANE COEFFICIENT
   LCB      (R)   **UNDEFINED**  LONGITUDINAL CENTER OF BUOYANCY AS FRACTION OF LBP AFT FP
   LCF      (R)   **UNDEFINED**  LONGITUDINAL CENTER OF FLOTATION AS FRACTION OF LBP AFT FP
   DEPTH10  (R)     0.26000E+02  DEPTH AMIDSHIPS AT CENTERLINE (FOOT          )
   DRAFTSON (R)     0.24000E+02  DRAFT OF SONAR DOME (FOOT          )
   DISPMLD  (R)   **UNDEFINED**  MOLDED DISPLACEMENT (LONG TON     )
   DISPTOT  (R)     0.45000E+04  TOTAL DESIGN DISPLACEMENT INCL. SHELL AND APP. (LONG TON     )
   WETSURF  (R)   **UNDEFINED**  WETTED SURFACE (FOOT  **2    )
   FOCSL    (I)               0  RAISED FORECASTLE (0=NO  1=YES)


                    PROPULSION AND POWERING

   PPTYP    (I)               2  TYPE OF PROPULSION PLANT (REED)
   SHP      (R)     0.70000E+05  TOTAL INSTALLED SHAFT HORSEPOWER (HP          )
   NSHAFT   (I)               2  NUMBER OF PROPELLER SHAFTS
   NE       (I)               2  NUMBER OF ENGINES
   NB       (I)               4  NUMBER OF BOILERS
   VSUS     (R)     0.33000E+02  MAXIMUM CONTINUOUS SUSTAINED SPEED (KNOT          )
   VEND     (R)     0.14000E+02  ENDURANCE SPEED (KNOT          )
   ENDUR    (R)     0.60000E+04  ENDURANCE RANGE (NAUT. MILE   )
   PRPTYP   (I)               1  TYPE OF PROPELLER (1=FP  2=CRP)
   DPROP    (R)   **UNDEFINED**  PROPELLER DIAMETER (FOOT          )
   RPM      (R)   **UNDEFINED**  PROPELLER RPM AT FULL POWER (RPM)
   SSEPTYP  (I)               1  TYPE OF PRIMARY SHIP SERVICE ELECTRICAL PLANT (REED)
   NSSG     (I)               4  NUMBER OF PRIMARY SHIP SERVICE GENERATORS
   KWSSER   (R)     0.20000E+04  INSTALLED PRIMARY SHIP SERVICE GENERATOR CAPACITY (KW          )
   EMETYP   (A)    ARRAY(  953)  TYPE OF SECONDARY OR EMERGENCY ELECTRICAL PLANT (REED)
   NEMG     (A)    ARRAY(  934)  NUMBER OF SECONDARY OR EMERGENCY GENERATORS OF EACH TYPE
   KWEMER   (R)     0.20000E+03  INSTALLED EMERGENCY OR SECONDARY GENERATOR CAPACITY (KW          )
   KWPEMG   (A)    ARRAY(  915)  CAPACITY PER SECONDARY OR EMERGENCY GENERATORS (KW          )
```

```
                 TRANSVERSE AND DIRECTIONAL STABILITY

GM       (R)      0.55000E+01  METACENTRIC HEIGHT UNCORRECTED (FOOT        )
FSURFCOR (R)    **UNDEFINED**  FREE SURFACE CORRECTION (FOOT        )
CI       (R)    **UNDEFINED**  WATERPLANE MOMENT OF INERTIA COEFFICIENT
FINSIBL  (I)                0  FIN STABILIZERS (0=NO  1=YES)
NRUDDER  (I)                2  NUMBER OF RUDDERS


                       WEAPONS PAYLOAD

TYPGUNS  (A)     ARRAY(   879)  TYPE OF GUNS (REED)
NGUNS    (A)     ARRAY(   859)  NUMBER OF GUNS OF EACH TYPE
TYPMSL   (I)              131  TYPE OF MISSILE LAUNCHERS (REED)
NMSL     (I)                1  NUMBER OF MISSILE LAUNCHERS
TYPCIWS  (I)                0  TYPE OF CLOSE-IN WEAPON SYSTEM (REED)
NCIWS    (I)                0  NUMBER OF CLOSE-IN WEAPON SYSTEMS
TYPBPDMS (I)                0  TYPE OF BASIC POINT DEFENSE MISSILE SYSTEM (REED)
NBPDMS   (I)                0  NUMBER OF BASIC POINT DEFENSE MISSILE LAUNCHERS
TYPTORPL (I)              180  TYPE OF TORPEDO LAUNCHERS (REED)
NTORPL   (I)                2  NUMBER OF TORPEDO LAUNCHERS
TYPASWL  (I)              148  TYPE OF ASW WEAPON LAUNCHERS (REED)
NASWL    (I)                1  NUMBER OF ASW LAUNCHERS


                 ELECTRONICS, FIRE CONTROL AND SENSORS

TYPSONAR (A)     ARRAY(   628)  TYPE OF SONAR SYSTEMS (REED)
TYPDOME  (I)               62  TYPE OF SONAR DOME (REED)
TYPSURAD (I)                9  TYPE OF SURFACE SEARCH RADAR (REED)
TYP3DAIR (I)               15  TYPE OF 3-D AIR SEARCH RADAR (REED)
TYP2DAIR (I)               14  TYPE OF 2-D AIR SEARCH RADAR (REED)
TYPGRAD  (I)    **UNDEFINED**  TYPE OF GUN FIRE CONTROL RADARS OR DIRECTORS (REED)
NGRAD    (I)                1  NUMBER OF GUN FIRE CONTROL RADARS OR DIRECTORS
TYPMRAD  (I)              300  TYPE OF MISSILE FIRE CONTROL RADARS OR DIRECTORS (REED)
NMSLRAD  (I)                2  NUMBER OF MISSILE FIRE CONTROL RADARS OR DIRECTORS
TYPFCSG  (I)    **UNDEFINED**  TYPE OF GUN FIRE CONTROL SYSTEM (REED)
TYPFCSM  (I)              110  TYPE OF MISSILE FIRE CONTROL SYSTEM (REED)
TYPASWFC (I)              184  TYPE OF ASW FIRE CONTROL SYSTEM (REED)
TYPTDS   (I)                0  TYPE OF TACTICAL DATA SYSTEM (REED)


                      AVIATION CAPABILITY

TYPHELO  (I)                0  TYPE OF HELICOPTERS CARRIED (REED)
NHELO    (I)                0  NUMBER OF HELICOPTERS CARRIED
HIFR     (I)                0  HELICOPTER IN-FLIGHT REFUELING CAPABILITY (1=YES  0=NO)
```

```
                          COMPLEMENT

   NOFF      (I)                20  NUMBER OF SHIP'S OFFICERS
   NCPO      (I)                17  NUMBER OF CHIEF PETTY OFFICERS IN SHIP'S CREW
   NENLCREW  (I)               302  NUMBER OF ENLISTED IN SHIPS CREW
   NFLAGOFF  (I)                 4  NUMBER OF OFFICERS ON FLAG STAFF
   NENLSTF   (I)                11  NUMBER OF ENLISTED ON FLAG STAFF
   NTROOPS   (I)                 0  NUMBER OF TROOPS

                     GENERAL MASS PROPERTIES

   TYPMATL   (A)     ARRAY(     1)  TYPE OF MATERIAL FOR HULL AND SUPERSTRUCTURE RESPECTIVELY (REED)
   WEIGHT17  (A)     ARRAY(      )  WEIGHTS OF WEIGHT GROUPS 1-7 RESPECTIVELY(LONG TON     )
   VCG17     (A)     ARRAY(      )  VERTICAL CENTERS OF GRAVITY OF WT. GROUPS 1-7 RESPECTIVELY (FOOT          )
   WTLOADS   (R)      0.12521E+04   WEIGHT OF GROUP 8 LOADS (LONG TON     )
   VCGLOADS  (R)      0.99000E+01   VERTICAL CENTER OF GRAVITY OF GROUP 8 LOADS (FOOT         )

THE ARRAYS

$NAME: TYPMATL , LENGTH=  2   (     1)

$    0.10000E+01    0.20000E+01

$NAME: TYPSONAR, LENGTH=  2   (   628)

$    0.49000E+02    0.0

$NAME: NGUNS   , LENGTH=  3   (   859)

$    0.10000E+01    0.10000E+01    0.0

$NAME: TYPGUNS , LENGTH=  3   (   879)

$    0.93000E+02    0.94000E+02    0.0

$NAME: KWPEMG  , LENGTH=  2   (   915)

$    0.10000E+03    0.0

$NAME: NEMG    , LENGTH=  2   (   934)

$    0.20000E+01    0.0

$NAME: EMETYP  , LENGTH=  2   (   953)

$    0.40000E+01    0.0
```

```
$NAME: WEIGHT17, LENGTH=   7

$    0.12243E+04    0.83120E+03    0.12250E+03    0.17590E+03    0.37520E+03
$    0.25400E+03    0.25810E+03

$NAME: VCG17    , LENGTH=   7

$    0.17600E+02    0.13200E+02    0.19000E+02    0.26700E+02    0.20000E+02
$    0.25900E+02    0.34800E+02
```

APPENDIX D

GENERAL DATABASE ENTRY CODES

TABLE D1

PAYLOAD SHOPPING LIST

ITEM	DEFINITION		ITEM	DEFINITION	
Radio Communications			26	SPS 53	
			27	SPS 55 W/IFF	(r)
1	FF (Non ASW Command and Cont)		28	SPS 48 E	(n)
2	FF (ASW Command and Control)		29	SPS 58	
3	DDG	(r)	30	SPN 6	
4	Baseline Strike Cruiser		31	SPN 10	
5	CG/CGN		32	SPN 12	
6	DD 963	(n)	33	SPN 35	
			34	SPN 42	
Radars			35	Beacon Video Processor	
			36	SPH 2 (RAVIR Mod 3)	
7	Target Acquisition System Mod 0		37	SPS 58C	
8	Target Acquisition System Mod 3		38	SPS 55	(n)
9	SPS 10		39	IFF	(n)
10	SPS 10 W/IFF				
11	SPS 26		**Sonars**		
12	SPS 29				
13	SPS 30		40	SQS 53 (DD 963)	(r)
14	SPS 37		41	SQS 56	
15	SPS 39A		42	SQS 23 (TRAM)	
16	SPS 40		43	SQQ 23	
17	SPS 40 W/IFF		44	SQS 26 (CX)	(r)
18	SPS 40A W/IFF		45	EDD 610E	
19	SPS 43		46	SQA 13 (VDS)	
20	SPS 43 W/IFF		47	SQS 35 (IVDS)	
21	SPS 48 (V)	(r)	48	UQN 4	
22	SPS 48 C		49	SQS 23	
23	SPS 49	(r)	50	TACTLASS	
24	SPS 49 W/IFF		51	Escort Towed Array System (ETAS)	
25	SPS 52B		52	SQS 38 (keel)	

SOURCE: Michael Reed, "Ship Synthesis Model for Naval Surface Ships" (O.E. and S.M. Thesis, Massachusetts Institute of Technology, 1975), Table 21.

TABLE D1 (Continued)

ITEM	DEFINITION	
53	505 Sonar	
54	VDS	(n)
55	SQR-19 Towed Array	(n)
Sonar Domes		
56	23 Keel Dome (Double, Rubber)	
57	23 Bow Dome	
58	26/53 Bow Dome	(r)
59	610E/505 Bow Dome	
60	23 Keel Dome	
61	610E/505 Keel Dome	
62	23 Keel Dome (Rubber)	
63	Blank	
Sonar Liquid		
64	Sonar Liquid (1 ton)	
Electronic Countermeasure (ECM)		
65	FF/FFG Basic	
66	DD/DDG/CG/CGN Basic (ECM & IR Decoy)	(r)
67	SLQ 32 (V2)	(n)
68	ALR-59	
69	WLR-8	
70	SLR-10 or BRD-4, SLR-11	
71	DTP Suite Three	(r)
72	Nixie	(n)

ITEM	DEFINITION	
Electronic Tactical Data Systems		
73	Conc C and C-FF	
74	Conv C and C-DD	
75	ASW C and C-FF-2C, 7D	
76	NTDS - 4C, 13D - DG/DGN	
77	NTDS - 2C, 9D - DDG	
78	NTDS - 3C, 15 - 18D	
79	NTDS - 3C, 15D - CG	
80	NTDS - 3C, 15D - CGN	
81	SSCDS - 1C	
82	Conv C and C - CG, CGN	
83	DDG C & C	(n)
Guns and Ammo Handling and Stowage		
84	3/50 SM, MK-34 w/Shield Mn DK	
85	3/50 SM, MK-34 w/Shield 01 LV	
86	3/50 SM, MK-34 w/o Shield 01 LV	
87	3/50 TM, MK-33 w/Shield Mn DK	
88	3/50 TM, MK-33 w/Shield 01 LV	
89	3/50 TM, MK-33 w/o Shield Mn DK	
90	3/50 TM, MK-33 w/o Shield 01 LV	
91	5/38 SM, MK-30 Mn DK	(r)
92	5/38 SM, MK-30 01 LV	(r)
93	5/54 SM, MK-42 Mn DK	(r)
94	5/54 SM, MK-42 01 LV	(r)
95	5/54 SM, LW, MK-45/0 Mn DK	(r)
96	5/54 SM, LW, MK-45/0 01 LV	(r)
97	8/55 SM, MK-71 Mod X Mn DK	(r)
98	8/55 SM, MK-71 Mod X 01 LV	(r)

TABLE D1 (Continued)

ITEM	DEFINITION	
99	50 Cal MG 02 LV	
100	Vulcan/Phalanx CIWS 01 LV	(r)
101	35 mm twin 01 LV	(r)
102	76 mm single 01 LV	(r)
103	76 mm single Mn DK	(r)
104	5/54, LW, MK-45, Mod 1	(n)
105	5/54, LW, MK-45, Mod X	(n)
Gun Fire Control Systems		
106	MK-86 (Surface only, no SPG 60, with seafire)	(r)
107	MK-37	
108	MK-56	
109	MK-63/26	
110	MK-68/6	
111	GFCS for 5"/54 w/AEGIS ILL.	
112	MK-86 (w/seafire and SPG 60)	(r)
113	MK-86 (LFS) Mod 4	
114	MK-86 with AAW and CWI MOD 5	
115	MK-87	
116	MK-92 CWI/STIR	(r)
117	MK-86 - 5 w/o SPQ 9	
118	Seafire	(n)
Gun Ammo		
119	3"/50 Rd.	
120	5"/38 Rd.	
121	5"/54 Rd.	
122	8"/55 Rd.	
123	40 mm	
124	20 mm	
125	Vulcan/Phalanx CIWS (1 rd)	(n)
126	Blank	
Rocket and Missile Launchers		
127	NATO Sea Sparrow, MK-2910 (8 boxes)	
128	VLS Deep Cell, 64 cell (61 missiles)	(n)
129	Terr-60 MK-10/7-8 Mn DK	
130	VLS Standard Cell, 64 cell (61 missiles)	(n)
131	Tartar, MK-13	
132	VLS Deep Cell, 32 cell (29 missiles)	(n)
133	VLS Standard Cell, 32 cell (29 missiles)	(n)
134	BPDMS, MK-25	
135	GMLS, MK-26 (MOD 0)	
136	GMLS, MK-26 (MOD 1)	
137	GMLS, MK-26 (MOD 2)	
138	5" SSR, MK-105	
139	CHAFFROC, 4 Launch	
140	Harpoon Launcher (MK-13)	
141	Harpoon (Box) w/4 Missiles	
142	IPMDS Launcher	
143	Redeye	
144	Sea Launched Cruise Missile (SLCM) w/4 missiles	
145	Near Term Laser Pointer Trainer	

TABLE D1 (Continued)

ITEM	DEFINITION	
146	Tarpon Canister Launcher w/4 missiles)	
147	Super RBOC (2 launchers)	(n)
ASW Rocket and Missile Launchers		
148	ASROC-8, MK-16/4 w/8 ASROC, 01 level	
149	ASROC-8, MK-16/4 w/8 ASROC, 02 level	
150	ASROC Reload, Mag & Handling Gear	
151	DASH Launch (Hangar)	
152	Blank	
Missile Fire Control System		
153	Near Term Laser System Less Pointer Trainer	
154	Tomahawk WCS MK 2	(n)
155	Weapons Direction System MK-13	
156	MK-74 FCS (1 DIR) (Tartar C)	
157	MK-74 FCS (2 DIR)	
158	MK-115 BPDMS FCS	
159	CHAFFROC FCS	
160	MK-99 FCS (2 chan, for SPY-1B)	(n)
161	MK-91 GMFCS (2 chan)	
162	AEGIS SPY-1	(n)
163	AEGIS SPY-1A	(n)
164	AEGIS SPY-1B	(n)
165	Harpoon FCS	
166	Tartar D FCS (2 chan)	(n)

ITEM	DEFINITION	
Missile & Rocket Ammo		
167	Tomahawk & Cannisters for VLS	(n)
168	Tomahawk (non VLS)	(n)
169	RIM 67A-Ter 2 DK	
170	SM-2, ASROC, Harpoon & Cannister for VLS	(n)
171	RIM 7H Sparrow	
172	5" Rocket, MK-10	
173	CHAFFROC	
174	Harpoon, ASROC, SM-2 (not VLS) or Tartar	(n)
175	Subroc (2 launcher ready service)	(n)
Torpedo Tubes, Handling & Stowage		
176	MK-25 TT 2 DK	
177	MK-25 TT 01 LV	
178	MK-32 Twin Mn DK	
179	MK-32 Twin 01 LV	
180	MK-32 Triple	(r)
181	Torpedo Countermeasure Launchers	
182	Hedgehog	
183	MK-32 Triple, 1 mount (in hull)	(n)
ASW and Tropedo Fire Control Systems		
184	MK-114 UBFCS	
185	MK-114/12 UBFCS	
186	MK-116 UBFCS	(r)
187	Drone Control SRW4C w/URW 15	

TABLE D1 (Continued)

ITEM	DEFINITION	
188	Drone Control SRW4C	
189	TORP FCS (MK-25) (Hull)	
190	TORP FCS (MK-25) (Supstr)	
191	Tarpon FCS Interface Alterations	
192	MK-309 UBFCS	(n)
ASW Ammo		
193	ASROC Reload (02 Level)	
194	ASROC Reload (01 Level)	
195	MK-37/0,3 2 DK	
196	MK-37/0,3 01 LV	
197	MK-37/1,2 2 DK	
198	MK-44 Mn DK	
199	MK-44 01 LV	
200	MK-46 Mn DK	
201	MK-48 Mn DK	
202	MK-48 2 DK	
203	MK-46 in hull	(n)
Helos		
204	Two LAMPS III (main deck)	
205	HASP-T Helo (main deck)	
206	One SH-3	(n)
207	One SH-2D	(n)
Helo Support		
208	LAMPS MK III Package	
209	LAMPS Control	
210	LAAV 1	
211	LAAV 2	
212	LAMPS (Platform & Refuel)	
213	One LAMPS III Hangar	
214	Helo Tie-Down	
215	Aero Stores (1000 ft^3)	(n)
216	Blank	
Aviation Liquids		
217	JP 5 (100 gal.)	
218	Av Gas (100 gal.)	
219	Av Lube Oil (100 gal.)	
220	Blank	
Small Arms		
221	Misc. - FF/FFG	
222	Misc. - DD/DDG/CG	
223	Misc. - Cruiser	
224	Misc. - (Marine Detach.)	
225	Misc. - Small Ships	
Aviation Ammo		
226	MK-46 Torp	
227	Blank	
228	Blank	
229	Blank	

TABLE D1 (Continued)

ITEM	DEFINITION	
Sewage Treatment Plant		
230	Sewage Treatment Plant (175 man)	
231	Blank	
Replenishment at Sea & Cargo Handling		
232	FAST System - Dest/Cruiser	
233	Blank	
Liquids		
234	NSFO (100 gal.)	
235	Diesel Oil (100 gal.)	
236	Potable Water (100 gal.)	
237	Liquid O_2 (100 gal.)	
238	Auto Gas (100 gal.)	
239	Blank	
Boats		
240	14' Punt	
241	26' Motor Whale Boat (Wherry)	
242	26' Personnel	
243	28' Personnel	
244	33' Utility	
245	33' Personnel	
246	35' Motor Boat	
247	40' Utility	
248	40' Personnel	
249	50' Motor Launch	
250	50' Utility	
251	Blank	
Future Development		
252	Weight Margin (1 ton)	
Armor		
253	Armor for GMLS	(n)
254	LVL II Armor for one 64 cell VLS	(n)
255	LVL II Armor for Torp Mag & EOS	(n)
256	LVL II CIC Anti-frag armor	(n)
257	LVL II Fwd & Aft Aegis	(n)
258	Frag Protection SPS-49 Room & Ill. Base	(n)
259	Armor for one 5" or 8" gun	(n)
Undefined Items		
260 thru 300	Blank	
300+	See TABLE D-2	

n: new item - 6 December 1979
r: updated item - 6 December 1979

TABLE D-2

SUPPLEMENTAL PAYLOAD SHOPPING LIST

ITEM	DEFINITION
Fire Control Radars and Directors	
300	SPG-51C
301	SPG-55
302	SPG-60
303	MK-51 Gun Fire Control Director
304	MK-63 Gun Fire Control Director
Missile Launchers and Fire Control Systems	
305	Tartar MK-11 GMLS
306	Tartar MK-22 GMLS
307	MK-11 MFCS
308	MK-76 MFCS

TABLE D-3

INDEX TO NON-PAYLOAD REED CODE

ITEM	CODE	MEANING
Propulsion Plant Type (PPTYP)	1	600 psi steam
	2	1200 psi steam
	3	1200 psi pressure-fired steam
	4	nuclear
	5	gas turbine first generation
	6	gas turbine second generation
	7	diesel
	8	COGAS
Ship Service Electric Plant Type (SSEPTYP)	1	steam
	2	gas turbine first generation
	3	gas turbine second generation
	4	low speed diesel
	5	medium speed diesel
	6	high speed diesel
Emergency Electric Plant Type (EMETYP)	1	gas turbine first generation
	2	gas turbine second generation
	3	low speed diesel
	4	medium speed diesel
	5	high speed diesel
Type of Material (TYPMATL)	1	steel
	2	aluminum

SOURCE: Michael Reed, "Ship Synthesis Model for Naval Surface Ships" (O.E. and S.M. Thesis, Massachusetts Institute of Technology, 1975).

APPENDIX E

SAMPLE WEIGHT AND VERTICAL CENTER OF

GRAVITY DATABASES

Note: These are edited versions of the listings of the databases obtained at the terminal. The actual listings of the items in each database is in a random order due to the hashing function employed during the storing of the entries.

```
$TITLE: ** WEIGHT DATABASE FOR U.S. DDG-2 'CHARLES F. ADAMS' CLASS        **
$  NAME     TYPE           VALUE   COMMENT

   W100     (R)      0.33980E+03  WT. OF SHELL PLATING (LONG TON     )
   W101     (R)      0.11400E+03  WT. OF LONG. AND TRANS. FRAMING (LONG TON     )
   W103     (R)      0.89400E+02  WT. OF PLATFORMS AND FLATS (LONG TON     )
   W107     (R)      0.19260E+03  WT. OF ALL DECKS (LONG TON     )
   W111     (R)      0.11270E+03  WT. OF SUPERSTRUCTURE (LONG TON     )
   W112     (R)      0.47600E+02  WT. OF PROPULSION FOUNDATIONS (LONG TON     )
   W113     (R)      0.71200E+02  WT. OF FDN FOR AUX. AND OTHER EQUIP (LONG TON     )
   W114     (R)      0.13020E+03  WT. OF STRUCTURAL BHDS (LONG TON     )
   W115     (R)      0.21200E+02  WT. OF TRUNKS AND ENCLOSURES (LONG TON     )
   W119     (R)      0.35200E+02  WT. OF CASTINGS AND FORGINGS (LONG TON     )
   W120     (R)      0.13000E+02  WT. OF SEA CHESTS (LONG TON     )
   W123     (R)      0.12700E+02  WT. OF DOORS, HATCHES, SCUTTLES (LONG TON     )
   W125     (R)      0.61000E+01  WT. OF MASTS AND KINGPOSTS (LONG TON     )
   W127     (R)      0.86000E+01  WT. OF SONAR DOMES (LONG TON     )
   W150     (R)      0.30000E+02  WT. OF WELDING, RIVETING AND FASTENINGS (LONG TON     )
   W200     (R)      0.22930E+03  WT. OF BOILERS AND ENERGY CONVERTERS (LONG TON     )
   W201     (R)      0.12820E+03  WT. OF PROPULSION UNITS (LONG TON     )
   W202     (R)      0.35200E+02  WT. OF MAIN CONDENSERS AND AIR EJECTORS (LONG TON     )
   W203     (R)      0.12760E+03  WT. OF PROPELLER, SHAFTING AND BEARINGS (LONG TON     )
   W204     (R)      0.24100E+02  WT. OF COMBUSTION AIR SUPPLY (LONG TON     )
   W205     (R)      0.16500E+02  WT. OF UPTAKES AND SMOKEPIPES (LONG TON     )
   W206     (R)      0.86000E+01  WT. OF PROPULSION CONTROL EQUIPMENT (LONG TON     )
   W207     (R)      0.64100E+02  WT. OF MAIN STEAM SYSTEM (LONG TON     )
   W208     (R)      0.62800E+02  WT. OF FEEDWATER AND CONDENSATE SYSTEMS (LONG TON     )
   W209     (R)      0.17100E+02  WT. OF CIRC. AND CLG. WATER SYSTEMS (LONG TON     )
   W210     (R)      0.15300E+02  WT. OF F. O. SERVICE SYSTEM (LONG TON     )
   W211     (R)      0.16900E+02  WT. OF LUBE OIL SYSTEM (LONG TON     )
   W250     (R)      0.13500E+02  WT. OF PROPULSION REPAIR PARTS (LONG TON     )
   W251     (R)      0.72000E+02  WT. OF PROPULSION OPERATING FLUIDS (LONG TON     )
   W300     (R)      0.51800E+02  WT. OF ELECTRICAL POWER GENERATION (LONG TON     )
   W301     (R)      0.10800E+02  WT. OF POWER DISTRIBUTION SWITCHBOARDS(LONG TON     )
   W302     (R)      0.40600E+02  WT. OF POWER DISTRIBUTION SYSTEM (LONG TON     )
   W303     (R)      0.14900E+02  WT. OF LIGHTING SYSTEM (LONG TON     )
   W350     (R)      0.44000E+01  WT. OF ELECTRICAL PLANT REPAIR PARTS (LONG TON     )
   W400     (R)      0.14000E+01  WT. OF NAVIGATIONAL EQUIPMENT (LONG TON     )
   W401     (R)      0.29200E+02  WT. OF I. C. SYSTEMS (LONG TON     )
   W402     (R)      0.57000E+02  WT. OF GFCS (LONG TON     )
   W403     (R)      0.13400E+02  WT. OF COUNTERMEASURES (NON-ELECTRONIC) (LONG TON     )
   W404     (R)      0.67300E+02  WT. OF ELECTRONIC COUNTERMEASURES (LONG TON     )
   W406     (R)    **UNDEFINED**  WT. OF ASW FC AND TORPEDO FC SYSTEMS (LONG TON     )
   W450     (R)      0.76000E+01  WT. OF COMM. AND CONT. REPAIR PARTS (LONG TON     )
```

WEIGHT DATABASE FOR DDG-2 CLASS (CONTINUED)

W500	(R)	0.47000E+01	WT. OF HEATING SYSTEMS (LONG TON)
W501	(R)	0.47200E+02	WT. OF VENTILATION SYSTEMS (LONG TON)
W502	(R)	0.21100E+02	WT. OF AIR COND. SYSTEMS (LONG TON)
W503	(R)	0.76000E+01	WT. OF REFR. SPACES, PLANT AND EQUIP. (LONG TON)
W504	(R)	0.20000E+00	WT. OF GAS, HEAF, AV. L. O., SEWAGE SYSTEMS (LONG TON)
W505	(R)	0.13700E+02	WT. OF PLUMBING INST. (LONG TON)
W506	(R)	0.34400E+02	WT. OF FIREMAIN, FLSHNG, SPRKLR, S.W. SVC SYSTEMS (LONG TON)
W507	(R)	0.96000E+01	WT. OF FIRE EXT. SYSTEMS (LONG TON)
W508	(R)	0.11300E+02	WT. OF DRNG, BALLAST, STBLZG TK SYSTEMS (LONG TON)
W509	(R)	0.64000E+01	WT. OF FRESH WATER SYSTEMS (LONG TON)
W510	(R)	0.15000E+01	WT. OF SCUPPERS AND DECK DRAINS (LONG TON)
W511	(R)	0.24900E+02	WT. OF F.O. AND D.O. FILL, VENT, STWG AND XFR SYS (LONG TON)
W512	(R)	0.37000E+01	WT. OF TANK HEATING SYSTEMS (LONG TON)
W513	(R)	0.84000E+01	WT. OF COMPRESSED AIR SYSTEMS (LONG TON)
W514	(R)	0.68300E+02	WT. OF AUX. STEAM, EXH. STEAM AND STEAM DRAINS (LONG TON)
W517	(R)	0.13300E+02	WT. OF DISTILLING PLANT (LONG TON)
W518	(R)	0.11300E+02	WT. OF STEERING SYSTEMS (LONG TON)
W519	(R)	0.26300E+02	WT. OF RUDDERS (LONG TON)
W520	(R)	0.28900E+02	WT. OF MOORING, TWNG, ANCH AND AC HNDLG, DK MCHRY (LONG TON)
W521	(R)	0.92000E+01	WT. OF ELEV., STORES HANDLING SYSTEMS (LONG TON)
W550	(R)	0.36000E+01	WT. OF AUXILIARY SYSTEMS REPAIR PARTS (LONG TON)
W551	(R)	0.19300E+02	WT. OF AUXILIARY SYSTEMS OP. FLUIDS (LONG TON)
W600	(R)	0.14600E+02	WT. OF HULL FITTINGS (LONG TON)
W601	(R)	0.22000E+02	WT. OF BOATS, BOAT STWG AND HNDLG (LONG TON)
W602	(R)	0.13000E+01	WT. OF RIGGING AND CANVAS (LONG TON)
W603	(R)	0.22000E+02	WT. OF LADDERS AND GRATINGS (LONG TON)
W604	(R)	0.22700E+02	WT. OF NON-STRUCTURAL BHDS AND DOORS (LONG TON)
W605	(R)	0.36300E+02	WT. OF PAINTING (LONG TON)
W606	(R)	0.14100E+02	WT. OF DECK COVERING (LONG TON)
W607	(R)	0.26400E+02	WT. OF HULL INSULATION (LONG TON)
W608	(R)	0.24600E+02	WT. OF STOREROOMS, STOWAGES AND LOCKERS (LONG TON)
W609	(R)	0.41000E+01	WT. OF EQUIP FOR UTILITY SPACES (LONG TON)
W610	(R)	0.10000E+02	WT. OF EQUIP FOR WKSHOPS, LABS AND TEST AREAS (LONG TON)
W611	(R)	0.11900E+02	WT. OF EQUIP. FOR GALLEY, PTRY, SCLRY AND COMSRY (LONG TON)
W612	(R)	0.31700E+02	WT. OF FURNISHINGS FOR LIVING SPACES (LONG TON)
W613	(R)	0.93000E+01	WT. OF FURNISHINGS FOR OFFICES, CONT. CTRS (LONG TON)
W614	(R)	0.13000E+01	WT. OF FURNISHINGS FOR MED. AND DENTAL SP. (LONG TON)
W650	(R)	0.18000E+01	WT. OF OUTFIT AND FRNSHNG REPAIR PARTS (LONG TON)
W700	(R)	0.23380E+03	WT. OF GUNS AND GUNMOUNTS (LONG TON)
W701	(R)	0.76000E+01	WT. OF AMMUNITION HANDLING SYSTEMS (LONG TON)
W702	(R)	0.82000E+01	WT. OF AMMUNITION STOWAGE (LONG TON)

WEIGHT DATABASE FOR DDG-2 CLASS'(CONTINUED)

```
W704     (R)   **UNDEFINED**  WT. OF MISSILE LAUNCHERS (SEE W700) (LONG TON     )
W705     (R)   **UNDEFINED**  WT. OF ASW ROCKET LAUNCHERS (SEE W700) (LONG TON     )
W750     (R)     0.47000E+01  WT. OF ARMAMENT REPAIR PARTS (LONG TON     )
W751     (R)     0.39000E+01  WT. OF ARMAMENT OPERATING FLUIDS (LONG TON     )
W800     (R)     0.39100E+02  WT. OF SHIPS OFFICERS, CREW AND EFFECTS (LONG TON     )
W803     (R)     0.96300E+02  WT. OF SHIPS AMMUNITION (LONG TON     )
W806     (R)     0.58900E+02  WT. OF PROVISIONS AND PERSONNEL STORES (LONG TON     )
W812     (R)     0.52700E+02  WT. OF POTABLE WATER (LONG TON     )
W813     (R)     0.77300E+02  WT. OF RESERVE FEEDWATER (LONG TON     )
W814     (R)     0.15800E+02  WT. OF SHIPS LUBE OIL (LONG TON     )
W816     (R)     0.87050E+03  WT. OF FUEL OIL (LONG TON     )
W817     (R)     0.41500E+02  WT. OF DIESEL OIL (LONG TON     )
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$TITLE: ** VCG DATABASE FOR U.S. DDG-2 'CHARLES F. ADAMS' CLASS **

$ NAME	TYPE	VALUE	COMMENT
VCG100	(R)	0.10500E+02	VCG OF SHELL PLATING (FOOT)
VCG101	(R)	0.10700E+02	VCG OF LONG. AND TRANS. FRAMING (FOOT)
VCG103	(R)	0.16200E+02	VCG OF PLATFORMS AND FLATS (FOOT)
VCG107	(R)	0.27200E+02	VCG OF ALL DECKS (FOOT)
VCG111	(R)	0.38100E+02	VCG OF SUPERSTRUCTURE (FOOT)
VCG112	(R)	0.53000E+01	VCG OF PROPULSION FOUNDATIONS (FOOT)
VCG113	(R)	0.18100E+02	VCG OF FDN FOR AUX. AND OTHER EQUIP (FOOT)
VCG114	(R)	0.14500E+02	VCG OF STRUCTURAL BHDS (FOOT)
VCG115	(R)	0.15700E+02	VCG OF TRUNKS AND ENCLOSURES (FOOT)
VCG119	(R)	0.11500E+02	VCG OF CASTINGS AND FORGINGS (FOOT)
VCG120	(R)	0.38000E+01	VCG OF SEA CHESTS (FOOT)
VCG123	(R)	0.25500E+02	VCG OF DOORS, HATCHES, SCUTTLES (FOOT)
VCG125	(R)	0.82000E+02	VCG OF MASTS AND KINGPOSTS (FOOT)
VCG127	(R)	-0.40000E+01	VCG OF SONAR DOMES (FOOT)
VCG150	(R)	0.17600E+02	VCG OF WELDING, RIVETING AND FASTENINGS (FOOT)
VCG200	(R)	0.13400E+02	VCG OF BOILERS AND ENERGY CONVERTERS (FOOT)
VCG201	(R)	0.13300E+02	VCG OF PROPULSION UNITS (FOOT)
VCG202	(R)	0.92000E+01	VCG OF MAIN CONDENSERS AND AIR EJECTORS (FOOT)
VCG203	(R)	0.54000E+01	VCG OF PROPELLERS, SHAFTING AND BEARINGS (FOOT)
VCG204	(R)	0.22200E+02	VCG OF COMBUSTION AIR SUPPLY (FOOT)
VCG205	(R)	0.52600E+02	VCG OF UPTAKES AND SMOKEPIPES (FOOT)
VCG206	(R)	0.16000E+02	VCG OF PROPULSION CONTROL EQUIPMENT (FOOT)
VCG207	(R)	0.20400E+02	VCG OF MAIN STEAM SYSTEM (FOOT)
VCG208	(R)	0.14600E+02	VCG OF FEEDWATER AND CONDENSATE SYSTEMS (FOOT)
VCG209	(R)	0.78000E+01	VCG OF CIRC. AND CLG. WATER SYSTEMS (FOOT)
VCG210	(R)	0.11400E+02	VCG OF F. O. SERVICE SYSTEM (FOOT)
VCG211	(R)	0.82000E+01	VCG OF LUBE OIL SYSTEM (FOOT)
VCG250	(R)	0.19500E+02	VCG OF PROPULSION REPAIR PARTS (FOOT)
VCG251	(R)	0.10600E+02	VCG OF PROPULSION OPERATING FLUIDS (FOOT)
VCG300	(R)	0.16900E+02	VCG OF ELECTRICAL POWER GENERATION (FOOT)
VCG301	(R)	0.18900E+02	VCG OF POWER DISTRIBUTION SWITCHBOARDS (FOOT)
VCG302	(R)	0.20000E+02	VCG OF POWER DISTRIBUTION SYSTEM (FOOT)
VCG303	(R)	0.25100E+02	VCG OF LIGHTING SYSTEM (FOOT)
VCG350	(R)	0.14400E+02	VCG OF ELECTRICAL PLANT REPAIR PARTS (FOOT)
VCG400	(R)	0.53600E+02	VCG OF NAVIGATIONAL EQUIPMENT (FOOT)
VCG401	(R)	0.18300E+02	VCG OF I. C. SYSTEMS (FOOT)
VCG402	(R)	0.37100E+02	VCG OF GUN FIRE CONTROL SYSTEMS (FOOT)
VCG403	(R)	0.19700E+02	VCG OF COUNTERMEASURES (NON-ELECTRONIC) (FOOT)
VCG404	(R)	0.23500E+02	VCG OF ELECTRONIC COUNTERMEASURES (FOOT)
VCG406	(R)	**UNDEFINED**	VCG OF ASW FC AND TORPEDO FC SYSTEMS (FOOT)
VCG450	(R)	0.16300E+02	VCG OF COMM. AND CONT. REPAIR PARTS (FOOT)

VCG DATABASE FOR DDG-2 CLASS (CONTINUED)

VCG500	(R)	0.25200E+02	VCG OF HEATING SYSTEMS (FOOT)
VCG501	(R)	0.30900E+02	VCG OF VENTILATION SYSTEMS (FOOT)
VCG502	(R)	0.18400E+02	VCG OF AIR COND. SYSTEMS (FOOT)
VCG503	(R)	0.18600E+02	VCG OF REFR. SPACES, PLANT AND EQUIP. (FOOT)
VCG504	(R)	0.12400E+02	VCG OF GAS, HEAT, AV. L.O., SEWAGE SYSTEMS (FOOT)
VCG505	(R)	0.26400E+02	VCG OF PLUMBING INST. (FOOT)
VCG506	(R)	0.16800E+02	VCG OF FIREMAIN, FLSHNG, SPRKLR, S.W. SVC SYSTEMS (FOOT)
VCG507	(R)	0.22900E+02	VCG OF FIRE EXT. SYSTEMS (FOOT)
VCG508	(R)	0.10600E+02	VCG OF DRNG, BALLAST, STBLZG TK SYSTEMS (FOOT)
VCG509	(R)	0.21900E+02	VCG OF FRESH WATER SYSTEM (FOOT)
VCG510	(R)	0.37400E+02	VCG OF SCUPPERS AND DECK DRAINS (FOOT)
VCG511	(R)	0.11200E+02	VCG OF F.O. AND D.O. FILL, VENT, STWG AND XFR SYS (FOOT)
VCG512	(R)	0.62000E+01	VCG OF TANK HEATING SYSTEMS (FOOT)
VCG513	(R)	0.20300E+02	VCG OF COMPRESSED AIR SYSTEMS (FOOT)
VCG514	(R)	0.18100E+02	VCG OF AUX. STEAM, EXH. STEAM AND STEAM DRAINS (FOOT)
VCG517	(R)	0.17300E+02	VCG OF DISTILLING PLANT (FOOT)
VCG518	(R)	0.18000E+02	VCG OF STEERING SYSTEMS (FOOT)
VCG519	(R)	0.13100E+02	VCG OF RUDDERS (FOOT)
VCG520	(R)	0.24000E+02	VCG OF MOORING, TWNG, ANCH AND AC HNDLG, DK MCHRY (FOOT)
VCG521	(R)	0.38500E+02	VCG OF ELEV., STORES HANDLING SYSTEMS (FOOT)
VCG550	(R)	0.19800E+02	VCG OF AUXILIARY SYSTEMS REPAIR PARTS (FOOT)
VCG551	(R)	0.16900E+02	VCG OF AUXILIARY SYSTEMS OP. FLUIDS (FOOT)
VCG600	(R)	0.32500E+02	VCG OF HULL FITTINGS (FOOT)
VCG601	(R)	0.40200E+02	VCG OF BOATS, BOAT STWG AND HNDLNG (FOOT)
VCG602	(R)	0.37600E+02	VCG OF RIGGING AND CANVAS (FOOT)
VCG603	(R)	0.13200E+02	VCG OF LADDERS AND GRATINGS (FOOT)
VCG604	(R)	0.28800E+02	VCG OF NON-STRUCTURAL BHDS AND DOORS (FOOT)
VCG605	(R)	0.20000E+02	VCG OF PAINTING (FOOT)
VCG606	(R)	0.26700E+02	VCG OF DECK COVERING (FOOT)
VCG607	(R)	0.28400E+02	VCG OF HULL INSULATION (FOOT)
VCG608	(R)	0.20700E+02	VCG OF STOREROOMS, STOWAGES AND LOCKERS (FOOT)
VCG609	(R)	0.21400E+02	VCG OF EQUIP FOR UTILITY SPACES (FOOT)
VCG610	(R)	0.23800E+02	VCG OF EQUIP FOR WKSHOPS, LABS AND TEST AREAS (FOOT)
VCG611	(R)	0.29700E+02	VCG OF EQUIP. FOR GALLEY, PTRY, SCLRY AND COMSRY (FOOT)
VCG612	(R)	0.26700E+02	VCG OF FURNISHINGS FOR LIVING SPACES (FOOT)
VCG613	(R)	0.30600E+02	VCG OF FRNSHNGS FOR OFFICES, CONT. CTRS. (FOOT)
VCG614	(R)	0.29700E+02	VCG OF FURNISHINGS FOR MED. AND DENTAL SP. (FOOT)
VCG650	(R)	0.15000E+02	VCG OF OUTFIT AND FURNISHING REPAIR PARTS (FOOT)
VCG700	(R)	0.35800E+02	VCG OF GUNS AND GUNMOUNTS (FOOT)
VCG701	(R)	0.33900E+02	VCG OF AMMUNITION HANDLING SYSTEMS (FOOT)
VCG702	(R)	0.19600E+02	VCG OF AMMUNITION STOWAGE (FOOT)

VCG DATABASE FOR DDG-2 CLASS (CONTINUED)

VCG704	(R)	**UNDEFINED**	VCG OF MISSILE LAUNCHERS (SEE VCG700) (FOOT)
VCG705	(R)	**UNDEFINED**	VCG OF ASW ROCKET LAUNCHERS (SEE VCG700) (FOOT)
VCG750	(R)	0.13500E+02	VCG OF ARMAMENT REPAIR PARTS (FOOT)
VCG751	(R)	0.33700E+02	VCG OF ARMAMENT OPERATING FLUIDS (FOOT)
VCG800	(R)	0.23500E+02	VCG OF SHIPS OFFICERS, CREW AND EFFECTS (FOOT)
VCG803	(R)	0.17200E+02	VCG OF SHIPS AMMUNITION (FOOT)
VCG806	(R)	0.16800E+02	VCG OF PROVISIONS AND PERSONNEL STORES (FOOT)
VCG812	(R)	0.44000E+01	VCG OF POTABLE WATER (FOOT)
VCG813	(R)	0.54000E+01	VCG OF RESERVE FEEDWATER (FOOT)
VCG814	(R)	0.17400E+02	VCG OF SHIPS LUBE OIL (FOOT)
VCG816	(R)	0.87000E+01	VCG OF FUEL OIL (FOOT)
VCG817	(R)	0.93000E+01	VCG OF DIESEL OIL (FOOT)

APPENDIX F

MACHWT MODULE LISTING

Note: Subroutines MAINPG and MODIO are included in the Cube Module listing in Appendix A and do not appear here.

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C------------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM--------------MWI00010
      SUBROUTINE INPUT(CALALL,IOFLAG)                                   MWI00020
C------------------SUBPROGRAM DESCRIPTION----------------------------    MWI00030
C      SUBROUTINE INPUT PROVIDES THE USER WITH A MENU FROM WHICH TO      MWI00040
C CHOOSE WHICH MODULE SEGMENT IT IS DESIRED TO OPERATE NEXT.  THE       MWI00050
C CHOICES ARE:                                                          MWI00060
C           ALL MODULE INPUT VARIABLES                                  MWI00070
C           THE MODULE UNITS TO BE USED DURING INPUT AND OUTPUT         MWI00080
C           THE MACHINERY WEIGHT ITEM TO BE ESTIMATED.                  MWI00090
C           THE DATA FROM EXISTING SHIPS TO BE USED FOR CURVE FITTING   MWI00100
C                FOR W(200) AND W(201)                                  MWI00110
C           THE CHARACTERISTICS OF THE NEW SHIP DESIGN NEEDED AS INPUT  MWI00120
C                TO ALLOW THE CALCULATIONS TO BE DONE                   MWI00130
C      THE UNITS MODULE ALLOWS THE USER TO SPECIFY THE LENGTH, FORCE    MWI00140
C AND TIME UNITS TO BE USED DURING INPUT AND OUTPUT.  LENGTH UNITS ARE  MWI00150
C NEEDED FOR LBP, PROPELLER DIAMETER, DRAFT AND POSSIBLY SPEED.  THESE  MWI00160
C ARE ALL USED IN CALCULATING W(203).  TIME UNITS MAY BE NEEDED FOR     MWI00170
C SPEED.  FORCE UNITS ARE NEEDED FOR WEIGHTS.                           MWI00180
C      THE MACHINERY WEIGHT ITEM NAME SHOULD BE READ BEFORE OTHER INPUT  MWI00190
C IS ENTERED.                                                           MWI00200
C      IN READING DATA FROM EXISTING DESIGNS FOR CURVE FITTING, THE USER MWI00210
C IS ASKED TO SPECIFY WHICH SEQUENTIAL NUMBER OF DATA POINTS THIS PAIR  MWI00220
C REPRESENTS.                                                           MWI00230
C------------------SUBPROGRAM ASSUMPTIONS------------------------------MWI00240
C NONE YET                                                              MWI00250
C------------------INPUT VARIABLES-------------------------------------- MWI00260
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR  MWI00270
C                 OCCURRED WHEN READING OR EDITING AN ESSENTIAL VARI-   MWI00280
C                 ABLE                                                  MWI00290
C         .FALSE. IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR  MWI00300
C                 OCCURRED WHEN READING OR EDITING AN ESSENTIAL VARI-   MWI00310
C                 ABLE                                                  MWI00320
C------------------INPUT VARIABLES--------------------------------------MWI00330
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE       MWI00340
C         .FALSE. THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE   MWI00350
C IOFLAG: DENOTES THE OPERATION TO BE PERFORMED                         MWI00360
C        =1 IF THE USER WISHES TO READ THE VARIABLES                    MWI00370
C         2                          EDIT                               MWI00380
C         3                          WRITE                              MWI00390
C---------------------LABELED COMMON VARIABLES-------------------------MWI00400
C LABELED COMMON DIALGF AND MDNCPW HAVE BEEN DEFINED IN SUBROUTINE      MWI00410
C MAINPG.                                                               MWI00420
C.........WTFLAG INITIALIZED IN BLOCK DATA                              MWI00430
C WFLAG : DENOTES WHICH WEIGHT ITEM IS TO BE ESTIMATED                  MWI00440
C        =1 FOR W(200)                                                  MWI00450
C        =2     W(201)                                                  MWI00460
C        =3     W(203)                                                  MWI00470
C.........CRVPTS INITIALIZED IN BLOCK DATA                              MWI00480
C NPTS  : THE NUMBER OF PAIRS OF POINTS TO BE FITTED                    MWI00490
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C IND    : AN ARRAY WHICH STORES THE VALUES OF THE INDEPENDENT VARIABLE  MW100500
C           FOR CURVE FITTING                                              MW100510
C DEP    : AN ARRAY WHICH STORES THE VALUES OF THE DEPENDENT VARIABLE    MW100520
C           FOR CURVE FITTING                                              MW100530
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED-------------------MW100540
C DEX                                                                      MW100550
C     INTIN                                                                MW100560
C     LMOVEC                                                               MW100570
C     MENUIN                                                               MW100580
C     MESOUT                                                               MW100590
C     STRPAK                                                               MW100600
C DEX LIBRARY                                                              MW100610
C     NONE                                                                 MW100620
C MODULI                                                                   MW100630
C     MWCHRT                                                               MW100640
C     MWUNIT                                                               MW100650
C     MWLIST                                                               MW100660
C                                                                          MW100670
C LABELED COMMONS                                                          MW100680
C                                                                          MW100690
      COMMON /DIALGT/ MTERSE                                               MW100700
      COMMON /MDNCPW/ NCPW                                                 MW100710
      COMMON /WTFLAG/ WFLAG                                                MW100720
      COMMON /CRVPTS/ NPTS,IND(10),DEP(10)                                 MW100730
C                                                                          MW100740
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                    MW100750
C                                                                          MW100760
      INTEGER IOFLAG,NCPW                                                  MW100770
      INTEGER MENUNM(2),NITEMS,ITEMS(12),ITEM                              MW100780
      INTEGER MESS(16),LMS                                                 MW100790
      INTEGER NPTS,NUPT,WFLAG                                              MW100800
      INTEGER READ(2),EDIT(2),WRITE(2)                                     MW100810
      LOGICAL CALALL,LOCALL                                                MW100820
      LOGICAL MTERSE,LOGVAL,LMOVEC,INTIN                                   MW100830
      REAL IND,DEP                                                         MW100840
C                                                                          MW100850
C VARIABLE DATA DEFINITIONS                                                MW100860
C                                                                          MW100870
      DATA LMS/16/                                                         MW100880
      DATA MENUNM/4HINPU,4HT   /                                           MW100890
      DATA NITEMS/6/                                                       MW100900
      DATA ITEMS/4HALL ,4H    ,                                            MW100910
     1           4HUNIT,4HS   ,                                            MW100920
     2           4HWT.I,4HTEM ,                                            MW100930
     3           4HCURV,4HEPTS,                                            MW100940
     4           4HNEWS,4HHIP ,                                            MW100950
     5           4HDONE,4H    /                                            MW100960
      DATA READ /4HREAD,4H.< /                                            MW100970
      DATA EDIT /4HEDIT,4H.< /                                            MW100980
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      DATA WRITE/4HWRIT,4HE.</                                          MW100990
C                                                                       MW101000
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.     MW101010
C NOTE THAT IF THE LOCAL ALL FLAG IS ACTIVATED HERE MENU 'INPUT' WILL   MW101020
C NOT BE DEFINED BY THIS INVOCATION OF SUBROUTINE MWINPT.               MW101030
C                                                                       MW101040
      LOCALL=CALALL                                                     MW101050
      IF (LOCALL) GO TO 200                                             MW101060
C                                                                       MW101070
C PREPARE A PROMPTING MESSAGE FOR MENU 'INPUT' AND THEN PROVIDE THE     MW101080
C MENU TO THE USER.                                                     MW101090
C                                                                       MW101100
    5 CONTINUE                                                          MW101110
      IF (MTERSE) GO TO 40                                              MW101120
      CALL STRPAK(MESS,LMS,4H<   ,40HSELECT WHICH INPUT VARIABLE SEGMENTMW101130
     1 10<)                                                             MW101140
      GO TO (10,20,30),IOFLAG                                           MW101150
   10 LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,40,NCPW)                         MW101160
      GO TO 50                                                          MW101170
   20 LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,40,NCPW)                         MW101180
      GO TO 50                                                          MW101190
   30 LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,40,NCPW)                        MW101200
      GO TO 50                                                          MW101210
   40 CALL STRPAK(MESS,LMS,4H<   ,21HWHICH INPUT SEGMENT?<)             MW101220
   50 CONTINUE                                                          MW101230
      ITEM MENUIN(MENUNM,NITEMS,ITEMS,MESS)                             MW101240
      GO TO (100,200,300,400,500,600),ITEM                              MW101250
C                                                                       MW101260
C SET THE INPUT ALL OPTION.                                             MW101270
C                                                                       MW101280
  100 CONTINUE                                                          MW101290
      LOCALL=.TRUE.                                                     MW101300
C                                                                       MW101310
C READ, EDIT OR WRITE THE INPUT/INPUT MODULE UNITS.                     MW101320
C                                                                       MW101330
  200 CONTINUE                                                          MW101340
      CALL MWUNIT(LOCALL,IOFLAG)                                        MW101350
      IF (LOCALL) GO TO 300                                             MW101360
      IF (.NOT.CALALL) GO TO 5                                          MW101370
      CALALL=.FALSE.                                                    MW101380
      GO TO 600                                                         MW101390
C                                                                       MW101400
C READ THE WEIGHT ITEM TO BE ESTIMATED.                                 MW101410
C                                                                       MW101420
  300 CONTINUE                                                          MW101430
      CALL MWLIST                                                       MW101440
      IF (LOCALL) GO TO 400                                             MW101450
      IF (.NOT.CALALL) GO TO 5                                          MW101460
      CALALL=.FALSE.                                                    MW101470
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      GO TO 600                                                         MW101480
C                                                                       MW101490
C READ, EDIT OR WRITE THE DATA FROM EXISTING SHIPS TO BE USED FOR CURVE MW101500
C FITTING.  IF THE USER IS INPUTTING DATA, FIRST QUERY THE USER TO      MW101510
C SPECIFY WHICH SEQUENTIAL PAIR OF DATA POINTS THIS REPRESENTS.         MW101520
C                                                                       MW101530
  400 CONTINUE                                                          MW101540
      IF (IOFLAG.NE.1) GO TO 450                                        MW101550
  410 CONTINUE                                                          MW101560
      CALL STRPAK(MESS,LMS,4H<   ,59HSPECIFY THE SEQUENTIAL NUMBER OF THMW101570
     1IS PAIR OF DATA POINTS.◁)                                         MW101580
      LOGVAL=INTIN(1,NEED,NUPT,MESS)                                    MW101590
      IF (LOGVAL) GO TO 440                                             MW101600
      CALL STRPAK(MESS,LMS,4H<   ,63HINTIN FAILED WHEN READING IN SEQUENMW101610
     1TIAL NUMBER OF DATA POINTS.◁)                                     MW101620
      CALL MESOUT(MESS)                                                 MW101630
      CALL STRPAK(MESS,LMS,4H<   ,49HTHIS INFORMATION IS ESSENTIAL. PLEAMW101640
     1SE TRY AGAIN.◁)                                                   MW101650
      CALL MESOUT(MESS)                                                 MW101660
      GO TO 50                                                          MW101670
  440 CONTINUE                                                          MW101680
      IF (NUPT.GT.NPTS) NPTS=NUPT                                       MW101690
  450 CONTINUE                                                          MW101700
      CALL MWCHRT(LOCALL,IOFLAG,NUPT)                                   MW101710
      IF (LOCALL) GO TO 500                                             MW101720
      IF (.NOT.CALALL) GO TO 5                                          MW101730
      CALALL=.FALSE.                                                    MW101740
      GO TO 600                                                         MW101750
C                                                                       MW101760
C READ, EDIT OR WRITE THE NEW SHIP CHARACTERISTICS.  IF INPUTTING DATA, MW101770
C PROMPT THE USER AS TO WHICH SUPPLEMENTAL INFORMATION IS NEEDED FOR    MW101780
C CALCULATING THE PARTICULAR WEIGHT ITEM.                               MW101790
C                                                                       MW101800
  500 CONTINUE                                                          MW101810
      NUPT=0                                                            MW101820
      IF (IOFLAG.EQ.3) GO TO 550                                        MW101830
      IF (WFLAG.NE.3) GO TO 530                                         MW101840
      CALL STRPAK(MESS,LMS,4H<   ,58HTO ESTIMATE W(203) THE FOLLOWING INMW101850
     1FORMATION IS REQUIRED:◁)                                          MW101860
      CALL MESOUT(MESS)                                                 MW101870
      CALL STRPAK(MESS,LMS,4H<   ,56HLBP   PPTYPE   SHP   NSHAFT   PRPTYP  VMW101880
     1SUS   DPROP(OPTIONAL)◁)                                           MW101890
      CALL MESOUT(MESS)                                                 MW101900
      GO TO 550                                                         MW101910
  530 CONTINUE                                                          MW101920
      CALL STRPAK(MESS,LMS,4H<   ,49HTO ESTIMATE W(200) OR W(201) INPUT MW101930
     1NEW SHIP SHP.◁)                                                   MW101940
      CALL MESOUT(MESS)                                                 MW101950
  550 CONTINUE                                                          MW101960
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      CALL MWCHRT(LOCALL,IOFLAG,NUPT)
      IF (LOCALL) GO TO 600
      IF (.NOT.CALALL) GO TO 5
      CALALL=.FALSE.
C
C RETURN CONTROL TO CALLING PROGRAM.
C
  600 CONTINUE
      RETURN
      END
```

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C------------MACHINERY WEIGHT MODULE SUBPROGRAM-------------------------MWU00010
      SUBROUTINE MWUNIT(CALALL,IOFLAG)                                  MWU00020
C------------------SUBPROGRAM DESCRIPTION-------------------------------MWU00030
C SUBROUTINE MWUNIT ALLOWS ITS USERS TO SELECT WHICH MODULE UNIT THEY   MWU00040
C WISH TO READ, EDIT OR WRITE.  THE CHOICES ARE:                        MWU00050
C         ALL MODULE      UNITS                                         MWU00060
C         THE LENGTH      UNIT                                          MWU00070
C         THE TIME        UNIT                                          MWU00080
C         THE FORCE       UNIT                                          MWU00090
C------------------SUBPROGRAM ASSUMPTIONS-------------------------------MWU00100
C IF THE CALLING PROGRAM ALL OPTION IS ACTIVE, THE LOCAL ALL OPTION IS  MWU00110
C SET TO .TRUE. UPON INVOKING THIS SUBROUTINE.  IN THIS CASE THE MENU ISMWU00120
C NOT DEFINED.                                                          MWU00130
C------------------OUTPUT VARIABLES-------------------------------------MWU00140
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR  MWU00150
C                 OCCURRED IN READING OR EDITING A MODULE UNIT          MWU00160
C         .FALSE. IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR  MWU00170
C                 OCCURRED IN READING OR EDITING A MODULE UNIT          MWU00180
C------------------INPUT VARIABLES--------------------------------------MWU00190
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE       MWU00200
C         .FALSE. THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE   MWU00210
C IOFLAG: DENOTES THE OPERATION TO BE PERFORMED                         MWU00220
C          1 IF THE USER WISHES TO READ MODULE UNITS                    MWU00230
C          2                       EDIT                                 MWU00240
C          3                       WRITE                                MWU00250
C------------------LABELED COMMON VARIABLES-----------------------------MWU00260
C LABELED COMMON DIALGF, INOUTF, MDNCPW AND REFNOS HAVE BEEN DEFINED IN MWU00270
C SUBROUTINE MAINPG.                                                    MWU00280
C LABELED COMMONS LUNITS, TUNITS, FUNITS, LUINFO, TUINFO AND FUINFO     MWU00290
C TUINFO AND FUINFO HAVE BEEN INITIALIZED IN SUBPROGRAM BLOCK DATA.     MWU00300
C------------------SUBPROGRAMS AND FUNCTIONS CALLED---------------------MWU00310
C DEX                                                                   MWU00320
C     STRPAK                                                            MWU00330
C     LMOVEC                                                            MWU00340
C     MENUIN                                                            MWU00350
C DEX LIBRARY                                                           MWU00360
C     LUNIT                                                             MWU00370
C     TUNIT                                                             MWU00380
C     FUNIT                                                             MWU00390
C MODULE                                                                MWU00400
C     NONE                                                              MWU00410
C-----------------------------------------------------------------------MWU00420
C                                                                       MWU00430
C LABELED COMMONS                                                       MWU00440
C                                                                       MWU00450
      COMMON /DIALGF/ MTERSE                                            MWU00460
      COMMON /INOUTF/ IMODE,OMODE                                       MWU00470
      COMMON /MDNCPW/ NCPW                                              MWU00480
      COMMON /REFNOS/ RNRFIL,RNWFIL                                     MWU00490
```

```
      COMMON /LUNITS/ PSTLUN,UIOLUN                                      MWU00500
      COMMON /TUNITS/ PSTTUN,UIOTUN                                      MWU00510
      COMMON /FUNITS/ PSTFUN,UIOFUN                                      MWU00520
      COMMON /LUINFO/ DBLUNN,DBLUNC,LUNFRM,DEFLUN                        MWU00530
      COMMON /TUINFO/ DBTUNN,DBTUNC,TUNFRM,DEFTUN                        MWU00540
      COMMON /FUINFO/ DBFUNN,DBFUNC,FUNFRM,DEFFUN                        MWU00550
C                                                                        MWU00560
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                  MWU00570
C                                                                        MWU00580
      INTEGER IOFLAG                                                     MWU00590
      INTEGER IMODE,OMODE,IOMODE                                         MWU00600
      INTEGER MESS(11),LMS,NCPW                                          MWU00610
      INTEGER ITEM,MENUIN,MENUNM(2),NITEMS,ITEMS(10)                     MWU00620
      INTEGER UIOLUN,UIOTUN,UIOFUN                                       MWU00630
      INTEGER DBLUNN(2),DBTUNN(2),DBFUNN(2)                              MWU00640
      INTEGER DBLUNC(16),DBTUNC(16),DBFUNC(16)                           MWU00650
      INTEGER LUNFRM(2),TUNFRM(2),FUNFRM(2)                              MWU00660
      INTEGER DEFLUN,DEFTUN,DEFFUN                                       MWU00670
      INTEGER RNRFIL,RNWFIL,RNFILE                                       MWU00680
      INTEGER PSTLUN,PSTTUN,PSTFUN                                       MWU00690
      INTEGER PMES(16)                                                   MWU00700
      INTEGER READ(2),EDIT(2),WRITE(2)                                   MWU00710
      LOGICAL MIERSE,PMPREP                                              MWU00720
      LOGICAL CALALL,LOCALL                                              MWU00730
      LOGICAL LOGVAL,LMOVEC                                              MWU00740
C                                                                        MWU00750
C VARIABLE DATA DEFINITIONS                                              MWU00760
C                                                                        MWU00770
      DATA LMS    /11/                                                   MWU00780
      DATA MENUNM/4HUNIT,4H     /                                        MWU00790
      DATA NITEMS/5/                                                     MWU00800
      DATA ITEMS /4HALL ,4H    ,                                         MWU00810
     2            4HLENG,4HTH  ,                                         MWU00820
     3            4HTIME,4H    ,                                         MWU00830
     4            4HFORC,4HE   ,                                         MWU00840
     5            4HDONE,4H    /                                         MWU00850
      DATA READ /4HREAD,4H.< /                                          MWU00860
      DATA EDIT /4HEDIT,4H.< /                                          MWU00870
      DATA WRITE/4HWRIT,4HE.< /                                         MWU00880
C                                                                        MWU00890
C INITIALIZE THE VALUE OF PMPREP.                                        MWU00900
C                                                                        MWU00910
      PMPREP=.TRUE.                                                      MWU00920
C                                                                        MWU00930
C SET THE VALUE OF IOMODE AND RNFILE ACCORDING TO WHETHER THE USER       MWU00940
C WISHES TO READ, EDIT OR WRITE.                                         MWU00950
C                                                                        MWU00960
      IF (IOFLAG.EQ.3) GO TO 10                                          MWU00970
      IOMODE=IMODE                                                       MWU00980
```

```
      RNFILE=RNRFIL                                                     MWU00990
      GO TO 15                                                          MWU01000
   10 CONTINUE                                                          MWU01010
      IOMODE=OMODE                                                      MWU01020
      RNFILE=RNWFIL                                                     MWU01030
C                                                                       MWU01040
C ACTIVATE THE LOCAL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.     MWU01050
C NOTE THAT IF THE LOCAL ALL OPTION IS SET IN THIS MANNER, MENU 'UNIT'  MWU01060
C IS NOT DEFINED BY THE INVOCATION OF THIS SUBROUTINE.                  MWU01070
C                                                                       MWU01080
   15 CONTINUE                                                          MWU01090
      LOCALL=CALALL                                                     MWU01100
      IF (LOCALL) GO TO 200                                             MWU01110
C                                                                       MWU01120
C PREPARE PROMPTING MESSAGE FOR MENU 'UNIT'.                            MWU01130
C                                                                       MWU01140
   20 IF (MTERSE) GO TO 40                                              MWU01150
      CALL STRPAK(MESS,LMS,4H<   ,22HSELECT WHICH UNIT TO<)         MWU01160
      GO TO (25,30,35),IOFLAG                                           MWU01170
   25 CONTINUE                                                          MWU01180
      LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,22,NCPW)                         MWU01190
      GO TO 50                                                          MWU01200
   30 CONTINUE                                                          MWU01210
      LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,22,NCPW)                         MWU01220
      GO TO 50                                                          MWU01230
   35 CONTINUE                                                          MWU01240
      LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,22,NCPW)                        MWU01250
      GO TO 50                                                          MWU01260
   40 CONTINUE                                                          MWU01270
      CALL STRPAK(MESS,LMS,4H<   ,12HWHICH UNIT?<)                  MWU01280
C                                                                       MWU01290
C SELECT AN ITEM FROM MENU 'UNIT' AND BRANCH ACCORDINGLY.               MWU01300
C                                                                       MWU01310
   50 CONTINUE                                                          MWU01320
      ITEM=MENUIN(MENUNM,NITEMS,ITEMS,MESS)                             MWU01330
      GO TO (100,200,300,400,500),ITEM                                  MWU01340
C                                                                       MWU01350
C ACTIVATE THE SUBPROGRAM'S ALL OPTION.                                 MWU01360
C                                                                       MWU01370
  100 CONTINUE                                                          MWU01380
      LOCALL=.TRUE.                                                     MWU01390
C                                                                       MWU01400
C READ, EDIT OR WRITE THE LENGTH UNIT.                                  MWU01410
C                                                                       MWU01420
  200 CONTINUE                                                          MWU01430
      CALL LUNIT(UIOLUN,LOCALL,                                         MWU01440
     1           IOFLAG,IOMODE,MTERSE,NCPW,                             MWU01450
     2           DBLUNN,DBLUNC,                                         MWU01460
     3           PMPREP,PMES,                                           MWU01470
```

```
     4            RNFILE,LUNFRM,
     5            DEFLUN)
      IF (LOCALL) GO TO 300
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
      GO TO 500
C
C READ, EDIT OR WRITE THE TIME UNIT.
C
  300 CONTINUE
      CALL TUNIT(UIOTUN,LOCALL,
     1            IOFLAG,IOMODE,MTERSE,NCPW,
     2            DBTUNN,DBTUNC,
     3            PMPREP,PMES,
     4            RNFILE,TUNFRM,
     5            DEFTUN)
      IF (LOCALL) GO TO 400
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
      GO TO 500
C
C READ, EDIT OR WRITE THE FORCE UNIT.
C
  400 CONTINUE
      CALL FUNIT(UIOFUN,LOCALL,
     1            IOFLAG,IOMODE,MTERSE,NCPW,
     2            DBFUNN,DBFUNC,
     3            PMPREP,PMES,
     4            RNFILE,FUNFRM,
     5            DEFFUN)
      IF (LOCALL) GO TO 500
      IF (.NOT.CALALL) GO TO 20
      CALALL=.FALSE.
C
C RETURN CONTROL TO THE CALLING PROGRAM.
C
  500 CONTINUE
      RETURN
      END
```

```
C-----------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM---------------
      SUBROUTINE MWLIST
C------------------SUBPROGRAM DESCRIPTION---------------------------
C     SUBROUTINE MWLIST SETS THE VALUE OF WFLAG WHEN THE USER SPECIFIES
C ONE OF THE FOLLOWING MACHINERY WEIGHT ITEMS TO BE ESTIMATED.
C          W(200) BOILERS AND ENERGY CONVERTERS
C          W(201) PROPULSION UNITS
C          W(203) PROPELLER, SHAFTING AND BEARINGS
C------------------SUBPROGRAM ASSUMPTIONS-------------------------------
C NONE YET
C---------------------LABELED COMMON VARIABLES-------------------------
C LABELED COMMON DIALGE HAS BEEN DEFINED IN SUBROUTINE MAINPG.
C LABELED COMMON WTFLAG HAS BEEN DEFINED IN SUBROUTINE MWINPT.
C------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------
C DEX
C     STRPAK
C     MENUIN
C DEX LIBRARY
C     NONE
C MODULE
C     NONE
C----------------------------------------------------------------------
C
C LABELED COMMONS
C
      COMMON /DIALGE/ MTERSE
      COMMON /WTFLAG/ WFLAG
C
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS
C
      INTEGER MENUNM(2),NITEMS,ITEMS(6),ITEM
      INTEGER MESS(12),LMS,WFLAG
      LOGICAL MTERSE
C
C VARIABLE DATA DEFINITIONS
C
      DATA LMS/12/
      DATA MENUNM/4HWT.I,4HTEMS/
      DATA NITEMS/3/
      DATA ITEMS/4HW200,4H    ,
     1           4HW201,4H    ,
     2           4HW203,4H    /
C
C PREPARE A PROMPTING MESSAGE FOR MENU 'WT.ITEMS' AND THEN PROVIDE THE
C MENU.
C
      IF (MTERSE) GO TO 10
      CALL STRPAK(MESS,LMS,4H<   ,48HSELECT THE DESIRED WEIGHT ITEM TO B
     1E ESTIMATED.<)
```

```
      GO TO 50
   10 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,19HWHICH WEIGHT ITEM?<
   50 CONTINUE
      ITEM MENUIN(MENUNM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300),ITEM
C
C USER WISHES TO ESTIMATE W(200).
  100 CONTINUE
      WFLAG=1
      GO TO 99999
C
C USER WISHES TO ESTIMATE W(200).
C
  200 CONTINUE
      WFLAG=2
      GO TO 99999
C
C USER WISHES TO ESTIMATE W(203).
C
  300 CONTINUE
      WFLAG=3
C
C RETURN TO CALLING PROGRAM
C
99999 CONTINUE
      RETURN
      END
```

```
C------------------MACHINERY WEIGHT MODULE SUBPROGRAM-----------------MWC00010
      SUBROUTINE MWCHRT(CALALL,IOFLAG,NUPT)                            MWC00020
C------------------SUBPROGRAM DESCRIPTION---------------------------   MWC00030
C     SUBROUTINE MWCHRT ALLOWS THE USER TO READ, EDIT OR WRITE THE     MWC00040
C FOLLOWING CHARACTERISTICS OF A SHIP DESIGN:                          MWC00050
C           LENGTH BETWEEN PERPENDICULARS                              MWC00060
C           DRAFT (KEEL)                                               MWC00070
C           TYPE OF PROPULSION PLANT                                   MWC00080
C           INSTALLED SHAFT HORSEPOWER                                 MWC00090
C           NUMBER OF PROPELLER SHAFTS                                 MWC00100
C           MAXIMUM SUSTAINED SPEED                                    MWC00110
C           TYPE OF PROPELLER (FP OR CRP)                              MWC00120
C           PROPELLER DIAMETER                                         MWC00130
C           WEIGHT OF BOILERS                                          MWC00140
C           WEIGHT OF PROPULSION UNITS                                 MWC00150
C           WEIGHT OF PROPELLER, SHAFTING AND BEARINGS                 MWC00160
C     THE FIRST 8 ITEMS CAN BE USED IN THE ESTIMATING OF THE LATTER 3  MWC00170
C FOR A NEW SHIP DESIGN.  WHEN OBTAINING DATA FOR CALCULATING PARAMETRICMWC00180
C EQUATIONS FOR ESTIMATING THE WEIGHTS, THE INDEPENDENT VARIABLE MUST  MWC00190
C BE READ FIRST AND THE DEPENDENT VARIABLE SECOND.                     MWC00200
C------------------SUBPROGRAM ASSUMPTIONS-----------------------------MWC00210
C     THIS SUBROUTINE IS ACCESSED THROUGH EITHER ITEM 'CURVE PT'       MWC00220
C OR ITEM 'NEW SHIP' OF SUBROUTINE MWEINP.  WHEN READING DATA POINTS   MWC00230
C THAT ARE TO BE USED FOR DETERMINING PARAMETRIC EQUATIONS, CHRCTR     MWC00240
C SHOULD BE ACCESSED VIA 'CURVE PT'.  WHEN READING IN SUPPLEMENTAL     MWC00250
C INFORMATION ABOUT THE NEW SHIP DESIGN NEEDED FOR OBTAINING THE PARTI- MWC00260
C CULAR WEIGHT ESTIMATE, IT SHOULD BE ACCESSED THROUGH 'NEW SHIP'.     MWC00270
C     BOTH VALUES OF A PAIR OF DATA POINTS MUST BE OBTAINED ONCE       MWC00280
C CHRCTR HAS BEEN ACCESSED BEFORE RETURNING TO THE CALLING PROGRAM.    MWC00290
C------------------OUTPUT VARIABLES-----------------------------------MWC00300
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR MWC00310
C                 OCCURRED WHILE READING OR EDITING A VITAL VARIABLE   MWC00320
C         .FALSE. IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR MWC00330
C                 OCCURRED WHILE READING OR EDITING A VITAL VARIABLE   MWC00340
C------------------INPUT VARIABLES------------------------------------MWC00350
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE      MWC00360
C         .FALSE. THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE  MWC00370
C IOFLAG: DENOTES THE OPERATION BEING PERFORMED                        MWC00380
C        =1 IF THE USER WISHES TO READ THE VARIABLES                   MWC00390
C         2                      EDIT                                  MWC00400
C         3                      WRITE                                 MWC00410
C NUPT  : A NUMBER WHICH INDICATES EITHER THE SEQUENTIAL NUMBER OF THE MWC00420
C         DATA POINTS TO BE READ OR THAT NEW SHIP INFORMATION IS       MWC00430
C         SOUGHT                                                       MWC00440
C--------------------LABELED COMMON VARIABLES-------------------------MWC00450
C LABELED COMMON DIALGF, INOUTF, MDNCPW AND REFNOS HAVE BEEN DEFINED IN MWC00460
C SUBROUTINE MAINPG.                                                   MWC00470
C LABELED COMMONS FUNITS,LUNITS AND TUNITS HAVE BEEN DEFINED IN        MWC00480
C SUBROUTINE MWUNIT.                                                   MWC00490
```

```
C.........VARFRM INITIALIZED IN BLOCK DATA                               MWC00500
C INTFRM: FORMAT TO BE USED FOR READING INTEGERS FROM OR WRITING INTE-   MWC00510
C         GERS TO A SEQUENTIAL FILE                                      MWC00520
C RSCFRM: FORMAT TO BE USED WHEN READING REAL SCALARS FROM OR WRITING    MWC00530
C         REAL SCALARS TO A SEQUENTIAL FILE                              MWC00540
C.........CRVPTS INITIALIZED IN BLOCK DATA                               MWC00550
C NPTS  : THE SEQUENTIAL NUMBER OF THE DATA PAIR BEING READ.  WHEN THE   MWC00560
C         LAST PAIR HAS BEEN ENTERED, NPTS WIL EQUAL THE TOTAL NUMBER    MWC00570
C         OF DATA POINTS.                                                MWC00580
C IND   : AN ARRAY CONTAINING THE VALUES OF THE INDEPENDENT VARIABLE TO MWC00590
C         BE USED FOR CURVE FITTING                                      MWC00600
C DEP   : AN ARRAY CONTAINING THE VALUES OF THE DEPENDENT VARIABLE TO BEMWC00610
C         USED FOR CURVE FITTING                                         MWC00620
C..........INFO2 INITIALIZED IN BLOCK DATA                               MWC00630
C LBPNAM: THE DATABASE NAME OF THE LENGTH BETWEEN PERPENDICULARS         MWC00640
C CMNT2 : THE DATABASE COMMENT WHICH DESCRIBES LBPNAM                    MWC00650
C DEF2  : THE DEFAULT VALUE FOR LBP                                      MWC00660
C..........INFO5 INITIALIZED IN BLOCK DATA                               MWC00670
C HNAME : THE DATABASE NAME OF THE DRAFT                                 MWC00680
C CMNT5 : THE DATABASE COMMENT WHICH DESCRIBES HNAME                     MWC00690
C DEF5  : THE DEFAULT VALUE FOR DRAFT                                    MWC00700
C..........INFO19 INITIALIZED IN BLOCK DATA                              MWC00710
C PPINAM: THE DATABASE NAME OF THE TYPE OF PROPULSION PLANT              MWC00720
C CMNT19: THE DATABASE COMMENT WHICH DESCRIBES PPINAM                    MWC00730
C DEF19 : THE DEFAULT VALUE FOR THE TYPE OF PROPULSION PLANT             MWC00740
C..........INFO20 INITIALIZED IN BLOCK DATA                              MWC00750
C SHPNAM: THE DATABASE NAME OF THE INSTALLED SHAFT HORSEPOWER            MWC00760
C CMNT20: THE DATABASE COMMENT WHICH DESCRIBES SHPNAM                    MWC00770
C DEF20 : THE DEFAULT VALUE FOR INSTALLED SHAFT HORSEPOWER               MWC00780
C..........INFO21 INITIALIZED IN BLOCK DATA                              MWC00790
C NSHFNM: THE DATABASE NAME FOR THE NUMBER OF PROPELLER SHAFTS           MWC00800
C CMNT21: THE DATABASE COMMENT WHICH DESCRIBES NSHFNM                    MWC00810
C DEF21 : THE DEFAULT VALUE FOR THE NUMBER OF PROPELLER SHAFTS           MWC00820
C..........INFO24 INITIALIZED IN BLOCK DATA                              MWC00830
C VSUSNM: THE DATABASE NAME FOR THE MAXIMUM SUSTAINED SPEED              MWC00840
C CMNT24: THE DATABASE COMMENT WHICH DESCRIBES VSUSNM                    MWC00850
C DEF24 : THE DEFAULT VALUE FOR THE MAXIMUM SUSTAINED SPEED              MWC00860
C..........INFO27 INITIALIZED IN BLOCK DATA                              MWC00870
C PRPNAM: THE DATABASE NAME FOR THE TYPE OF PROPELLER                    MWC00880
C CMNT27: THE DATABASE COMMENT WHICH DESCRIBES PRPNAM                    MWC00890
C DEF27 : THE DEFAULT VALUE FOR THE TYPE OF PROPELLER                    MWC00900
C..........INFO28 INITIALIZED IN BLOCK DATA                              MWC00910
C DPRPNM: THE DATABASE NAME FOR THE PROPELLER DIAMETER                   MWC00920
C CMNT28: THE DATABASE COMMENT WHICH DESCRIBES DPRPNM                    MWC00930
C DEF28 : THE DEFAULT VALUE FOR THE PROPELLER DIAMETER                   MWC00940
C..........INF200 INITIALIZED IN BLOCK DATA                             MWC00950
C W200NM: THE DATABASE NAME FOR THE WEIGHT OF BOILERS AND ENERGY         MWC00960
C         CONVERTERS                                                     MWC00970
C W200C : THE DATABASE COMMENT WHICH DESCRIBES W200NM                    MWC00980
```

```
C DEF200: THE DEFAULT VALUE FOR THE WEIGHT OF BOILERS AND ENERGY
C         CONVERTERS
C..........INF201 INITIALIZED IN BLOCK DATA
C W201NM: THE DATABASE NAME FOR THE WEIGHT OF PROPULSION UNITS
C W201C : THE DATABASE COMMENT WHICH DESCRIBES W200NM
C DEF201: THE DEFAULT VALUE FOR THE WEIGHT OF PROPULSION UNITS
C..........INF203 INITIALIZED IN BLOCK DATA
C W203NM: THE DATABASE NAME FOR THE WEIGHT OF PROPELLER, SHAFTING
C         AND BEARINGS
C W203C : THE DATABASE COMMENT WHICH DESCRIBES W203NM
C DEF203: THE DEFAULT VALUE FOR THE WEIGHT OF PROPELLER, SHAFTING
C         AND BEARINGS
C..........NEWINI INITIALIZED IN BLOCK DATA
C LBPNEW: THE VALUE OF THE LENGTH BETWEEN PERPENDICULARS OF THE NEW SHIP
C HNEW  : THE VALUE OF THE KEEL DRAFT OF THE NEW SHIP
C PPTNEW: THE VALUE OF THE TYPE OF PROPULSION PLANT OF THE NEW SHIP
C SHPNEW: THE VALUE OF THE INSTALLED SHAFT HORSEPOWER OF THE NEW SHIP
C NSHNEW: THE VALUE OF THE NUMBER OF PROPELLER SHAFTS OF THE NEW SHIP
C VSUSNU: THE VALUE OF THE MAXIMUM SUSTAINED SPEED OF THE NEW SHIP
C PRTNEW: THE VALUE OF THE TYPE OF PROPELLER OF THE NEW SHIP
C DPRNEW: THE VALUE OF THE PROPELLER DIAMETER OF THE NEW SHIP
C W200NU: THE VALUE OF THE WEIGHT OF THE BOILERS AND ENERGY CONVERTERS
C         OF THE NEW SHIP
C W201NU: THE VALUE OF THE WEIGHT OF PROPULSION UNITS OF THE NEW SHIP
C W203NU: THE VALUE OF THE WEIGHT OF PROPELLER, SHAFTING AND BEARINGS
C         OF THE NEW SHIP
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED-------------------
C DEX
C     SIRPAK
C     LMOVEC
C     MENUIN
C     MESOUT
C DEX LIBRARY
C     ISCLDR
C     ISCEDT
C     ISDMP
C     RSCLDR
C     RSCEDT
C     RSCDMP
C     UNITFF
C     UNITLF
C     UNITTF
C MODULE
C     NONE
C
C LABELED COMMONS
C
      COMMON /DIALGF/ MTERSE
      COMMON /MDNCPW/ NCPW
```

```
      COMMON /INOUTT/ IMODE,OMODE
      COMMON /REFNOS/ RNRFIL,RNWFIL
      COMMON /VARFRM/ INTFRM,RSCFRM
      COMMON /FUNITS/ PSTFUN,UIOFUN
      COMMON /LUNITS/ PSTLUN,UIOLUN
      COMMON /TUNITS/ PSTTUN,UIOTUN
      COMMON /CRVPTS/ NPTS,IND(10),DEP(10)
      COMMON /INFO2/  LBPNAM,CMNT2,DEF2
      COMMON /INFO5/  HNAME,CMNT5,DEF5
      COMMON /INFO19/ PPTNAM,CMNT19,DEF19
      COMMON /INFO20/ SHPNAM,CMNT20,DEF20
      COMMON /INFO21/ NSHFNM,CMNT21,DEF21
      COMMON /INFO24/ VSUSNM,CMNT24,DEF24
      COMMON /INFO27/ PRPNAM,CMNT27,DEF27
      COMMON /INFO28/ DPRPNM,CMNT28,DEF28
      COMMON /INF200/ W200NM,W200C,DEF200
      COMMON /INF201/ W201NM,W201C,DEF201
      COMMON /INF203/ W203NM,W203C,DEF203
      COMMON /NEWINF/ LBPNEW,HNEW,PPTNEW,SHPNEW,NSHNEW,VSUSNU,PRTNEW,
     1                DPRNEW,W200NU,W201NU,W203NU
C
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS
C
      INTEGER IOFLAG,IMODE,OMODE,NCPW
      INTEGER RNRFIL,RNWFIL,INTFRM(2),RSCFRM(2)
      INTEGER PSTFUN,UIOFUN,PSTLUN,UIOLUN,PSTTUN,UIOTUN
      INTEGER NUPT
      INTEGER IVAR,IDEF,DBNAME(2),PMES(16),PMORGN(16)
      INTEGER LBPNAM(2), HNAME(2),PPTNAM(2),SHPNAM(2),NSHFNM(2),
     1        VSUSNM(2),PRPNAM(2),DPRPNM(2),W200NM(2),W201NM(2),
     2        W203NM(2)
      INTEGER CMNT2(16),CMNT5(16),CMNT19(8),CMNT20(12),CMNT21(7),
     1        CMNT24(16),CMNT27(7),CMNT28(9),W200C(13),W201C(10),
     2        W203C(14)
      INTEGER DEF19,DEF21,DEF27
      INTEGER PPTNEW,NSHNEW,PRTNEW
      INTEGER MESS(16),LMS
      INTEGER MENUNM(2),NITEMS,ITEMS(24),ITEM
      INTEGER MENUYS(2),NITEMY,ITEMY(4),YTEM
      INTEGER READ(2),EDIT(2),WRITE(2)
      INTEGER UNITNM(3),NAML02(1),NAML06(2),NAML12(3),NAMF02(1),
     1        NAMF03(1),NAMF12(3),NAMT02(1),NAMT03(1),NAMT06(2),
     2        NAMT12(3),UNSPEE(3),KNOT(3),UNSHP(3),UNKW(3)
      LOGICAL CALALL,MTERSE,LOGVAL,LMOVEC
      LOGICAL MENUFL,PMPREP,VITAL
      LOGICAL ISCLDR,ISCEDT,ISCDMP,RSCLDR,RSCEDT,RSCDMP
      LOGICAL UNITFF,UNITLF,UNITTF,USPEED
      REAL DEF2,DEF5,DEF20,DEF24,DEF28,DEF200,DEF201,DEF203
      REAL LPBNEW,HNEW,SHPNEW,VSUSNU,DPRNEW,W200NU,W201NU,W203NU
```

```
      REAL IND,DEP
      REAL UNITFM,UNITFA,CONVLM,CONVLA,CONVFM,CONVFA,UFSPEE,UFSPEA
      REAL RVAR,RDEF
C
C VARIABLE DATA DEFINITIONS
C
      DATA LMS/16/
      DATA MENUNM/4HCHAR,4HACT./
      DATA NITEMS/12/
      DATA ITEMS/4HLBP ,4H    ,
     1           4HDRAF,4HT   ,
     2           4HPPTY,4HPE  ,
     3           4HSHP ,4H    ,
     4           4HMAXS,4HPEED,
     5           4HNO.S,4HHAFT,
     6           4HTYPS,4HCREW,
     7           4HDIAM,4H PRP,
     8           4HW200,4H    ,
     9           4HW201,4H    ,
     *           4HW203,4H    ,
     1           4HDONE,4H    /
      DATA MENUYS/4HMDYE,4HS-NO/
      DATA NITEMY/2/
      DATA ITEMY/4HYES ,4H    ,
     1           4HNO  ,4H    /
      DATA KNOT /4HKNOT,4HS   ,4H    /
      DATA UNSHP/4HHP  ,4H    ,4H    /
      DATA UNKW /4HKW  ,4H    ,4H    /
      DATA READ /4HREAD,4H.< /
      DATA EDIT /4HEDIT,4H.< /
      DATA WRITE/4HWRIT,4HE.< /
      DATA CONVLA,CONVFA,CONVTA,UFSPEA /0.0,0.0,0.0,0.0/
C
C INITIALIZE PMPREP AND MENUFL.
C
      PMPREP=.TRUE.
      MENUFL=.FALSE.
C
C DETERMINE THE NAMES OF THE LENGTH UNITS FOR LBP, PROPELLER DIAMETER,
C SPEED, HORSEPOWER AND DRAFT AND THE MULTIPLICATION CONVERSION FACTOR.
C
      LOGVAL=UNITLF(CONVLM,NAML02,NAML06,NAML12,CALALL,
     1              PSTLUN,UIOLUN,NCPW)
      IF (.NOT.LOGVAL) GO TO 99999
C
C DETERMINE THE NAMES OF THE TIME UNITS FOR SPEED
C AND THE MULTIPLICATIVE CONVERSION FACTOR.
C
      LOGVAL=UNITTF(CONVTM,NAMT02,NAMT03,NAMT06,NAMT12,CALALL,
```

```
     1              PSTIUN,UIOTUN,NCPW)
      IF (.NOT.LOGVAL) GO TO 99999
C
C DETERMINE THE NAMES OF THE FORCE UNITS FOR THE WEIGHTS
C OF THE MACHINERY ITEMS AND THE MULTIPLICATIVE CONVERSION FACTOR.
C
      LOGVAL=UNITFF(CONVFM,NAMF02,NAMF03,NAMF12,CALALL,
     1              PSTFUN,UIOFUN,NCPW)
      IF (.NOT.LOGVAL) GO TO 99999
C
C PREPARE A PROMPTING MESSAGE FOR MENU 'CHARACT.' AND PROVIDE IT
C TO USER.
C
      N=0
    5 CONTINUE
      IF (MIERSE) GO TO 40
      CALL STRPAK(MESS,LMS,4H<   ,32HSELECT WHICH CHARACTERISTIC TO<)
      GO TO (10,20,30),IOFLAG
   10 CONTINUE
      LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,32,NCPW)
      GO TO 50
   20 CONTINUE
      LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,32,NCPW)
      GO TO 50
   30 CONTINUE
      LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,32,NCPW)
      GO TO 50
   40 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,22HWHICH CHARACTERISTIC?<)
   50 CONTINUE
      ITEM MENUIN(MENUNM,NITEMS,ITEMS,MESS)
C
C PROVIDE INDICATOR TO TELL IF VARIABLE TO BE READ IS AN INDEPENDENT
C VARIABLE, A DEPENDENT VARIABLE OR A NEW SHIP CHARACTERISTIC.
C
      N=N+1
      IF (NUPT.EQ.0) N=0
      IF (N.EQ.3.AND.ITEM.NE.12) GO TO 8000
      GO TO (100,200,300,400,500,600,700,800,900,1000,1100,99999),ITEM
C
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,
C EDIT OR WRITE THE LBP.
C
  100 CONTINUE
      IF (IOFLAG.EQ.3) RVAR=LBPNEW
      DBNAME(1)=LBPNAM(1)
      DBNAME(2)=LBPNAM(2)
      UNITEM=CONVLM
      UNITFA=CONVLA
```

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      UNITNM(1)=NAML12(1)                                               MWC02950
      UNITNM(2)=NAML12(2)                                               MWC02960
      UNITNM(3)=NAML12(3)                                               MWC02970
      DO 110 I=1,16                                                     MWC02980
      PMORGN(I)=CMNT2(I)                                                MWC02990
  110 CONTINUE                                                          MWC03000
      RDEF=DEF2                                                         MWC03010
      GO TO (2100,2200,2300),IOFLAG                                     MWC03020
C                                                                       MWC03030
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,    MWC03040
C EDIT OR WRITE THE DRAFT.                                              MWC03050
C                                                                       MWC03060
  200 CONTINUE                                                          MWC03070
      IF (IOFLAG.EQ.3) RVAR=HNEW                                        MWC03080
      DBNAME(1)=HNAME(1)                                                MWC03090
      DBNAME(2)=HNAME(2)                                                MWC03100
      UNITIM=CONVIM                                                     MWC03110
      UNITIA=CONVIA                                                     MWC03120
      UNITNM(1)=NAML12(1)                                               MWC03130
      UNITNM(2)=NAML12(2)                                               MWC03140
      UNITNM(3)=NAML12(3)                                               MWC03150
      DO 210 I=1,16                                                     MWC03160
      PMORGN(I)=CMNT5(I)                                                MWC03170
  210 CONTINUE                                                          MWC03180
      RDEF=DEF5                                                         MWC03190
      GO TO (2100,2200,2300),IOFLAG                                     MWC03200
C                                                                       MWC03210
C SUBSTITUTE VARIABLES AND BRANCH ACCORDING TO WHETHER TO READ,         MWC03220
C EDIT OR WRITE THE TYPE OF PROPULSION PLANT.                           MWC03230
C                                                                       MWC03240
  300 CONTINUE                                                          MWC03250
      IF (IOFLAG.EQ.3) IVAR=PPTNEW                                      MWC03260
      DBNAME(1)=PPTNAM(1)                                               MWC03270
      DBNAME(2)=PPTNAM(2)                                               MWC03280
      DO 310 I=1,8                                                      MWC03290
      PMORGN(I)=CMNT19(I)                                               MWC03300
  310 CONTINUE                                                          MWC03310
      IDEF=DEF19                                                        MWC03320
      GO TO (3100,3200,3300),IOFLAG                                     MWC03330
C                                                                       MWC03340
C SUBSTITUTE VARIABLES AND BRANCH ACCORDING TO WHETHER TO READ,         MWC03350
C EDIT OR WRITE THE INSTALLED SHP.                                      MWC03360
C                                                                       MWC03370
  400 CONTINUE                                                          MWC03380
      IF (IOFLAG.EQ.3) RVAR=SHPNEW                                      MWC03390
      DBNAME(1)=SHPNAM(1)                                               MWC03400
      DBNAME(2)=SHPNAM(2)                                               MWC03410
C                                                                       MWC03420
C PREPARE MESSAGE FOR READING, EDITING OR WRITING SHAFT HORSEPOWER.     MWC03430
```

```
C                                                                       MWC03440
      CALL STRPAK(MESS,LMS,4H<  ,54HSHAFT HORSEPOWER MUST BE IN UNITS OMWC03450
     1F EITHER HP OR KW.◁                                               MWC03460
      CALL MESOUT(MESS)                                                 MWC03470
      CALL STRPAK(MESS,LMS,4H<  ,38HARE THE UNITS OF SHAFT HORSEPOWER HMWC03480
     1P?◁                                                               MWC03490
      YTEM MENUIN(MENUYS,NITEMY,ITEMY,MESS)                             MWC03500
      GO TO (410,420),YTEM                                              MWC03510
C                                                                       MWC03520
C THE I/O UNITS OF SHP ARE HP.                                         MWC03530
C                                                                       MWC03540
  410 CONTINUE                                                          MWC03550
      UNITIM-1.0                                                        MWC03560
      UNITNM(1)=UNSHP(1)                                                MWC03570
      UNITNM(2)=UNSHP(2)                                                MWC03580
      UNITNM(3)=UNSHP(3)                                                MWC03590
      GO TO 440                                                         MWC03600
C                                                                       MWC03610
C THE I/O UNITS OF SHP ARE KW.                                         MWC03620
C                                                                       MWC03630
  420 CONTINUE                                                          MWC03640
      UNITIM 1.3410                                                     MWC03650
      UNITNM(1)=UNKW(1)                                                 MWC03660
      UNITNM(2)=UNKW(2)                                                 MWC03670
      UNITNM(3)=UNKW(3)                                                 MWC03680
  440 CONTINUE                                                          MWC03690
      UNITIA=0.0                                                        MWC03700
      DO 450 I=1,12                                                     MWC03710
      PHORGN(I)=CMNT20(I)                                               MWC03720
  450 CONTINUE                                                          MWC03730
      RDEF DEF20                                                        MWC03740
      GO TO (2100,2200,2300),IOFLAG                                     MWC03750
C                                                                       MWC03760
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,    MWC03770
C EDIT OR WRITE THE SPEED.  FIRST PREPARE A PROMPTING MESSAGE FOR       MWC03780
C READING SPEED.                                                        MWC03790
C                                                                       MWC03800
  500 CONTINUE                                                          MWC03810
      CALL STRPAK(MESS,LMS,4H<  ,33HDOES VSUS HAVE UNITS OF 'KNOTS'?◁ MWC03820
      YTEM MENUIN(MENUYS,NITEMY,ITEMY,MESS)                             MWC03830
      GO TO (510,520),YTEM                                              MWC03840
  510 CONTINUE                                                          MWC03850
      CALL STRPAK(MESS,LMS,4H<  ,24HTHANK YOU.  PROCEEDING.◁)         MWC03860
      CALL MESOUT(MESS)                                                 MWC03870
      UNITNM(1)=KNOT(1)                                                 MWC03880
      UNITNM(2)=KNOT(2)                                                 MWC03890
      UNITNM(3)=KNOT(3)                                                 MWC03900
      UNITEM=1.0                                                        MWC03910
      GO TO 530                                                         MWC03920
```

```
  520 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,62HTHE CONVERSION FACTORS FOR CHANGING
     1 THE INPUT/OUTPUT UNITS TO<
      CALL MESOUT(MESS)
      CALL STRPAK(MESS,LMS,4H<   ,64HTHE PROGRAM STANDARD UNITS OF KNOTS
     1 WILL BE BASED ON THE LENGTH)
      CALL MESOUT(MESS)
      CALL STRPAK(MESS,LMS,4H<   ,35HAND TIME UNITS YOU HAVE SPECIFIED.<
     1)
      CALL MESOUT(MESS)
      LOGVAL=USPEED(UISPEE,UNSPEE,CALALL,
     1              CONVLM,CONVTM,NAML06,NAMT02,
     2              UIOLUN,UIOTUN,NCPW)
      IF (.NOT.LOGVAL) GO TO 99999
      UNITIM=UFSPEE/1.688
      UNITNM(1)=UNSPEE(1)
      UNITNM(2)=UNSPEE(2)
      UNITNM(3)=UNSPEE(3)
  530 CONTINUE
      IF (IOFLAG.EQ.3) RVAR=VSUSNU
      DBNAME(1)=VSUSNM(1)
      DBNAME(2)=VSUSNM(2)
      UNITTA=0.0
      DO 550 I=1,16
      PMORGN(I)=CMNT24(I)
  550 CONTINUE
      RDEF DEF24
      GO TO (2100,2200,2300),IOFLAG
C
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,
C EDIT OR WRITE THE NUMBER OF PROPELLER SHAFTS.
C
  600 CONTINUE
      IF (IOFLAG.EQ.3) IVAR=NSHNEW
      DBNAME(1)=NSHFNM(1)
      DBNAME(2)=NSHFNM(2)
      DO 610 I=1,7
      PMORGN(I)=CMNT21(I)
  610 CONTINUE
      IDEF=DEF21
      GO TO (3100,3200,3300),IOFLAG
C
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,
C EDIT OR WRITE THE TYPE OF PROPELLER.
C
  700 CONTINUE
      IF (IOFLAG.EQ.3) IVAR=PRTNEW
      DBNAME(1)=PRPNAM(1)
      DBNAME(2)=PRPNAM(2)
```

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      DO 710 I=1,7                                                      MWC04420
      PMORGN(I)=CMNT27(I)                                               MWC04430
  710 CONTINUE                                                          MWC04440
      IDEF=DEF27                                                        MWC04450
      GO TO (3100,3200,3300),IOFLAG                                     MWC04460
C                                                                       MWC04470
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,    MWC04480
C EDIT OR WRITE THE PROPELLER DIAMETER.                                 MWC04490
C                                                                       MWC04500
  800 CONTINUE                                                          MWC04510
      IF (IOFLAG.EQ.3) RVAR=DPRNEW                                      MWC04520
      DBNAME(1)=DPRPNM(1)                                               MWC04530
      DBNAME(2)=DPRPNM(2)                                               MWC04540
      UNITFM=CONVLM                                                     MWC04550
      UNITFA=CONVIA                                                     MWC04560
      UNITNM(1)=NAML12(1)                                               MWC04570
      UNITNM(2)=NAML12(2)                                               MWC04580
      UNITNM(3)=NAML12(3)                                               MWC04590
      DO 810 I=1,9                                                      MWC04600
      PMORGN(I)=CMNT28(I)                                               MWC04610
  810 CONTINUE                                                          MWC04620
      RDEF=DEF28                                                        MWC04630
      GO TO (2100,2200,2300),IOFLAG                                     MWC04640
C                                                                       MWC04650
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,    MWC04660
C EDIT OR WRITE W(200).                                                 MWC04670
C                                                                       MWC04680
  900 CONTINUE                                                          MWC04690
      IF (IOFLAG.EQ.3) RVAR=W200NU                                      MWC04700
      DBNAME(1)=W200NM(1)                                               MWC04710
      DBNAME(2)=W200NM(2)                                               MWC04720
      UNITFM=CONVFM                                                     MWC04730
      UNITFA=CONVFA                                                     MWC04740
      UNITNM(1)=NAMF12(1)                                               MWC04750
      UNITNM(2)=NAMF12(2)                                               MWC04760
      UNITNM(3)=NAMF12(3)                                               MWC04770
      DO 910 I=1,13                                                     MWC04780
      PMORGN(I)=W200C(I)                                                MWC04790
  910 CONTINUE                                                          MWC04800
      RDEF=DEF200                                                       MWC04810
      GO TO (2100,2200,2300),IOFLAG                                     MWC04820
C                                                                       MWC04830
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,    MWC04840
C EDIT OR WRITE W(201).                                                 MWC04850
C                                                                       MWC04860
 1000 CONTINUE                                                          MWC04870
      IF (IOFLAG.EQ.3) RVAR=W201NU                                      MWC04880
      DBNAME(1)=W201NM(1)                                               MWC04890
      DBNAME(2)=W201NM(2)                                               MWC04900
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      UNITFM=CONVFM
      UNITFA=CONVFA
      UNITNM(1)=NAMF12(1)
      UNITNM(2)=NAMF12(2)
      UNITNM(3)=NAMF12(3)
      DO 1010 I=1,10
      PMORGN(I)=W201C(I)
 1010 CONTINUE
      RDEF=DEF201
      GO TO (2100,2200,2300),IOFLAG
C
C SUBSTITUTE VARIABLES AND THEN BRANCH ACCORDING TO WHETHER TO READ,
C EDIT OR WRITE W(203).
C
 1100 CONTINUE
      IF (IOFLAG.EQ.3) RVAR=W203NU
      DBNAME(1)=W203NM(1)
      DBNAME(2)=W203NM(2)
      UNITFM=CONVFM
      UNITFA=CONVFA
      UNITNM(1)=NAMF12(1)
      UNITNM(2)=NAMF12(2)
      UNITNM(3)=NAMF12(3)
      DO 1110 I=1,14
      PMORGN(I)=W203C(I)
 1110 CONTINUE
      RDEF=DEF203
      GO TO (2100,2200,2300),IOFLAG
C
C READ A REAL VARIABLE.
C
 2100 CONTINUE
      LOGVAL=RSCLDR(RVAR,CALALL,
     1                 MIERSE,IMODE,NCPW,
     2                 DBNAME,UNITFM,UNITFA,UNITNM,.FALSE.,
     3                 PMPREP,PMES,PMORGN,
     4                 RNRFIL,RSCFRM,RDEF)
      IF (.NOT.LOGVAL) GO TO 5
      IF (NUPT.EQ.0) GO TO 2150
      IF (N.EQ.2) GO TO 2125
      IND(NUPT)=RVAR
      GO TO 5
 2125 CONTINUE
      DEP(NUPT)=RVAR
      GO TO 5
 2150 CONTINUE
      GO TO (5010,5020,5,5040,5050,5,5,5080,5090,5100,5110,99999),ITEM
C
C EDIT THE REAL VARIABLE.
```

```
C                                                                       MWC05400
 2200 CONTINUE                                                          MWC05410
      LOGVAL=RSCEDT(RVAR,CALALL,                                        MWC05420
     1                 MTERSE,NCPW,                                     MWC05430
     2                 DBNAME,UNITFM,UNITFA,UNITNM,                     MWC05440
     3                 PMPREP,PMES,PMORGN)                              MWC05450
      IF (.NOT.LOGVAL) GO TO 5                                          MWC05460
      IF (NUPT.EQ.0) GO TO 2250                                         MWC05470
      IF (N.EQ.2) GO TO 2225                                            MWC05480
      IND(NUPT)=RVAR                                                    MWC05490
      GO TO 5                                                           MWC05500
 2225 CONTINUE                                                          MWC05510
      DEP(NUPT)=RVAR                                                    MWC05520
      GO TO 5                                                           MWC05530
 2250 CONTINUE                                                          MWC05540
      GO TO (5010,5020,5,5040,5050,5,5,5080,5090,5100,5110,99999),ITEM  MWC05550
C                                                                       MWC05560
C WRITE THE REAL VARIABLE.                                              MWC05570
C                                                                       MWC05580
 2300 CONTINUE                                                          MWC05590
      LOGVAL=RSCDMP(CALALL,                                             MWC05600
     1                 MTERSE,OMODE,NCPW,                               MWC05610
     2                 RVAR,DBNAME,UNITFM,UNITFA,UNITNM,                MWC05620
     3                 PMPREP,PMES,PMORGN,                              MWC05630
     4                 RNWFIL,RSCFRM)                                   MWC05640
      GO TO 5                                                           MWC05650
C                                                                       MWC05660
C READ THE INTEGER VARIABLE.                                            MWC05670
C                                                                       MWC05680
 3100 CONTINUE                                                          MWC05690
      LOGVAL=ISCLDR(IVAR,CALALL,                                        MWC05700
     1                 MTERSE,IMODE,NCPW,                               MWC05710
     2                 DBNAME,.FALSE.,                                  MWC05720
     3                 MENUFL,MENUNM,NITEMS,ITEMS,                      MWC05730
     4                 PMPREP,PMES,PMORGN,                              MWC05740
     5                 RNRFIL,INTFRM,IDEF)                              MWC05750
      IF (.NOT.LOGVAL) GO TO 5                                          MWC05760
      GO TO (5,5,6030,5,5,6060,6070,5,5,5,5,99999),ITEM                 MWC05770
C                                                                       MWC05780
C EDIT THE INTEGER VARIABLE.                                            MWC05790
C                                                                       MWC05800
 3200 CONTINUE                                                          MWC05810
      LOGVAL=ISCEDT(IVAR,CALALL,                                        MWC05820
     1                 MTERSE,NCPW,                                     MWC05830
     2                 DBNAME,                                          MWC05840
     3                 MENUFL,MENUNM,NITEMS,ITEMS,                      MWC05850
     4                 PMPREP,PMES,PMORGN,                              MWC05860
     5                 IDEF)                                            MWC05870
      IF (.NOT.LOGVAL) GO TO 5                                          MWC05880
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      GO TO (5,5,6030,5,5,6060,6070,5,5,5,5,99999),ITEM                 MWC05890
C                                                                       MWC05900
C WRITE THE INTEGER VARIABLE.                                           MWC05910
C                                                                       MWC05920
 3300 CONTINUE                                                          MWC05930
      LOGVAL=ISCDMP(CALALL,                                             MWC05940
     1              MTERSE,OMODE,NCPW,                                  MWC05950
     2              IVAR,DBNAME,PMORGN,                                 MWC05960
     3              PMPREP,PMES,                                        MWC05970
     4              RNRFIL,ISCFRM)                                      MWC05980
      GO TO 5                                                           MWC05990
C                                                                       MWC06000
C ASSIGN RVAR TO THE NEW SHIP LBP.                                      MWC06010
C                                                                       MWC06020
 5010 CONTINUE                                                          MWC06030
      LBPNEW=RVAR                                                       MWC06040
      GO TO 5                                                           MWC06050
C                                                                       MWC06060
C ASSIGN RVAR TO THE NEW SHIP DRAFT.                                    MWC06070
C                                                                       MWC06080
 5020 CONTINUE                                                          MWC06090
      HNEW RVAR                                                         MWC06100
      GO TO 5                                                           MWC06110
C                                                                       MWC06120
C ASSIGN RVAR TO THE NEW SHIP SHP.                                      MWC06130
C                                                                       MWC06140
 5040 CONTINUE                                                          MWC06150
      SHPNEW=RVAR                                                       MWC06160
      GO TO 5                                                           MWC06170
C                                                                       MWC06180
C ASSIGN RVAR TO THE NEW SHIP VSUS.                                     MWC06190
C                                                                       MWC06200
 5050 CONTINUE                                                          MWC06210
      VSUSNU=RVAR                                                       MWC06220
      GO TO 5                                                           MWC06230
C                                                                       MWC06240
C ASSIGN RVAR TO THE NEW SHIP DPROP.                                    MWC06250
C                                                                       MWC06260
 5080 CONTINUE                                                          MWC06270
      DPRNEW=RVAR                                                       MWC06280
      GO TO 5                                                           MWC06290
C                                                                       MWC06300
C ASSIGN RVAR TO THE NEW SHIP W(200).                                   MWC06310
C                                                                       MWC06320
 5090 CONTINUE                                                          MWC06330
      W200NU=RVAR                                                       MWC06340
C                                                                       MWC06350
C ASSIGN RVAR TO THE NEW SHIP W(201).                                   MWC06360
C                                                                       MWC06370
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 5100 CONTINUE                                                          MWC06380
      W201NU=RVAR                                                       MWC06390
      GO TO 5                                                           MWC06400
C                                                                       MWC06410
C ASSIGN RVAR TO THE NEW SHIP W(203).                                   MWC06420
 5110 CONTINUE                                                          MWC06430
      W203NU=RVAR                                                       MWC06440
      GO TO 5                                                           MWC06450
C                                                                       MWC06460
C ASSIGN IVAR TO THE NEW SHIP PPTYPE.                                   MWC06470
C                                                                       MWC06480
 6030 CONTINUE                                                          MWC06490
      PPTNEW=IVAR                                                       MWC06500
      GO TO 5                                                           MWC06510
C                                                                       MWC06520
C ASSIGN IVAR TO THE NEW SHIP NSHFT.                                    MWC06530
C                                                                       MWC06540
 6060 CONTINUE                                                          MWC06550
      NSHNEW=IVAR                                                       MWC06560
      GO TO 5                                                           MWC06570
C                                                                       MWC06580
C ASSIGN IVAR TO THE NEW SHIP PRPTYPE.                                  MWC06590
C                                                                       MWC06600
 6070 CONTINUE                                                          MWC06610
      PRTNEW=IVAR                                                       MWC06620
      GO TO 5                                                           MWC06630
C                                                                       MWC06640
C ERROR IN READING DATA FOR CURVE FITTING.  INFORM USER.                MWC06650
C                                                                       MWC06660
 8000 CONTINUE                                                          MWC06670
      CALL STRPAK(MESS,LMS,4H<   ,57HYOU HAVE READ IN TOO MANY NUMBERS FMWC06680
     1OR THIS PAIR OF DATA.<)                                          MWC06690
      CALL MESOUT(MESS)                                                 MWC06700
      CALL STRPAK(MESS,LMS,4H<   ,57HRE-SELECT THE CURVEPTS ITEM IN MENUMWC06710
     1 INPUT AND TRY AGAIN.<)                                          MWC06720
      CALL MESOUT(MESS)                                                 MWC06730
      GO TO 99999                                                       MWC06740
C                                                                       MWC0675C
C RETURN TO CALLING PROGRAM.                                            MWC06760
C                                                                       MWC06770
99999 CONTINUE                                                          MWC06780
      RETURN                                                            MWC06790
      END                                                               MWC06800
```

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C------------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM--------------MWC00010
      SUBROUTINE MWCOMP                                                 MWC00020
C------------------SUBPROGRAM DESCRIPTION---------------------------    MWC00030
C     SUBROUTINE MWCOMP USES THE DATA FROM EXISTING SHIPS TO ESTIMATE   MWC00040
C EITHER W(200) OR W(201) AS A FUNCTION OF SHP.  W(203) IS ESTIMATED    MWC00050
C BASED ON A SET OF FIXED PARAMETRIC CURVES.                            MWC00060
C     THE STANDARD UNITS OF THIS PROGRAM ARE FEET, TONS AND KNOTS.      MWC00070
C------------------SUBPROGRAM ASSUMPTIONS-------------------------------MWC00080
C THE MAXIMUM NUMBER OF PAIRS OF DATA POINTS TO BE FITTED IS 10.        MWC00090
C---------------------LABELED COMMON VARIABLES--------------------------MWC00100
C LABELED COMMON MDNCPW HAS BEEN DEFINED IN SUBROUTINE MAINPG.          MWC00110
C LABELED COMMONS CRVPTS AND WTFLAG HAVE BEEN DEFINED IN SUBROUTINE     MWC00120
C MWINPT.  LABELED COMMON NEWINF HAS BEEN DEFINED IN SUBROUTINE MWCHRT. MWC00130
C LABELED COMMON COEFFS HAS BEEN DEFINED IN SUBROUTINE MWCOEF.          MWC00140
C------------------SUBPROGRAMS AND FUNCTIONS CALLED---------------------MWC00150
C DEX                                                                   MWC00160
C     STRPAK                                                            MWC00170
C     LMOVEC                                                            MWC00180
C     MISOUT                                                            MWC00190
C DEX LIBRARY                                                           MWC00200
C     NONE                                                              MWC00210
C MODULE                                                                MWC00220
C     LINFIT                                                            MWC00230
C-----------------------------------------------------------------------MWC00240
C                                                                       MWC00250
C LABELED COMMONS                                                       MWC00260
C                                                                       MWC00270
      COMMON /MDNCPW/ NCPW                                              MWC00280
      COMMON /CRVPTS/ NPTS,IND(10),DEP(10)                              MWC00290
      COMMON /NEWINF/ LBPN,HN,PPTN,SHPN,NSHN,VSUSN,PRTN,DPRN,W200N,     MWC00300
     1                W201N,W203N                                       MWC00310
      COMMON /WTFLAG/ WFLAG                                             MWC00320
      COMMON /COEFFS/ C(2)                                              MWC00330
C                                                                       MWC00340
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS                 MWC00350
C                                                                       MWC00360
      INTEGER NCPW,NPTS,WFLAG                                           MWC00370
      INTEGER PPTN,NSHN,PRTN                                            MWC00380
      INTEGER MESS(16),LMS                                              MWC00390
      LOGICAL CALALL,LOCALL                                             MWC00400
      LOGICAL MTERSE,LOGVAL,LMOVEC                                      MWC00410
      REAL IND,DEP,C                                                    MWC00420
      REAL LBPN,HN,SHPN,VSUSN,DPRN,W200N,W201N,W203N                    MWC00430
      REAL W,W203S,W203P,W203B                                          MWC00440
      REAL F,FF,RPM                                                     MWC00450
C                                                                       MWC00460
C VARIABLE DATA DEFINITIONS                                             MWC00470
C                                                                       MWC00480
      DATA LMS/16/                                                      MWC00490
```

```
C
C BRANCH ACCORDING TO WHICH WEIGHT ITEM IS TO BE ESTIMATED.
C
      GO TO (100,100,300),WFLAG
C
C FOR MACHINERY WEIGHT ITEM W(200) AND W(201), FIT A STRAIGHT LINE TO
C THE DATA POINTS PROVIDED.  OBTAIN THE SLOPE AND Y-INTERCEPT COEFFI-
C CIENTS.
C
  100 CONTINUE
      DO 150 I=1,NPTS
      WRITE (18,7000) I,IND(I),DEP(I)
  150 CONTINUE
 7000 FORMAT(1X,I10,1X,E13.6,1X,E13.6)
      CALL LINFIT(NPTS,IND,DEP,C)
C
C ESTIMATE THE NEW SHIP WEIGHT.
C
      W=C(1)*SHPN + C(2)
      IF (WFLAG.EQ.2) GO TO 200
      W200N=W
      GO TO 99999
  200 CONTINUE
      W201N=W
      GO TO 99999
C
C FOR W(203), FIRST ESTIMATE THE PROPELLER DIAMETER IF NOT SPECIFIED.
C
  300 CONTINUE
      IF (DPRN.NE.0.) GO TO 320
      IF (HN.EQ.0.) GO TO 8100
      IF (NSHN.EQ.1) GO TO 310
      DPRN=4.28*(HN**0.4283)
      GO TO 320
  310 CONTINUE
      DPRN=2.603*(HN**0.629)
C
C ESTIMATE RPM.
C
  320 CONTINUE
      IF (VSUSN.EQ.0.) GO TO 8200
      RPMN=96.12*(VSUSN/DPRN) + 52.15
C
C ESTIMATE WEIGHT FOR SHAFTING FOR FIXED PITCH AND CRP PROPELLERS
C DEPENDING ON TYPE OF PROPULSION PLANT.
C
      IF (PPIN.LE.4) F=.36
      IF (PPIN.GT.4) F=.20
      IF (PRIN.EQ.2) GO TO 330
```

```
      W203S=F*LBPN*NSHN*((.0134*((SHPN/(NSHN*RPMN))**.6667))**.9497)    MWC00990
      GO TO 340                                                         MWC01000
  330 CONTINUE                                                          MWC01010
      FF=F*LBPN*NSHN*(1. + .5*FLOAT(NSHN))                              MWC01020
      W203S=FF*((.0134*((SHPN/(NSHN*RPMN))**.6667))**.9497)             MWC01030
C                                                                       MWC01040
C ESTIMATE PROPELLER WEIGHT FOR FP AND CRP TYPES.                       MWC01050
C                                                                       MWC01060
  340 CONTINUE                                                          MWC01070
      IF (PRTN.EQ.2) GO TO 345                                          MWC01080
      W203P=.00146*(DPRN**3.279)*NSHN                                   MWC01090
      GO TO 350                                                         MWC01100
  345 CONTINUE                                                          MWC01110
      W203P=.00314*(DPRN**3.128)*NSHN                                   MWC01120
C                                                                       MWC01130
C ESTIMATE BEARING WEIGHT.                                              MWC01140
C                                                                       MWC01150
  350 CONTINUE                                                          MWC01160
      W203B=.15*(W203S+W203P)                                           MWC01170
C                                                                       MWC01180
C ESTIMATE TOTAL W(203)                                                 MWC01190
C                                                                       MWC01200
      W203=W203S+W203P+W203B                                            MWC01210
      GO TO 99999                                                       MWC01220
C                                                                       MWC01230
C ERROR MESSAGE.  DRAFT OF NEW SHIP NOT SPECIFIED.                      MWC01240
C                                                                       MWC01250
 8100 CONTINUE                                                          MWC01260
      CALL STRPAK(MESS,LMS,4H<   ,55HA VALUE FOR NEW SHIP DRAFT IS NEEDEMWC01270
     1D.  RETURN TO INPUT<)                                             MWC01280
      CALL MESOUT(MESS)                                                 MWC01290
      CALL STRPAK(MESS,LMS,4H<   ,14HAND ENTER IT.<)                    MWC01300
      CALL MESOUT(MESS)                                                 MWC01310
      GO TO 99999                                                       MWC01320
C                                                                       MWC01330
C ERRROR MESSAGE.  VSUS OF NEW SHIP NOT SPECIFIED.                      MWC01340
C                                                                       MWC01350
 8200 CONTINUE                                                          MWC01360
      CALL STRPAK(MESS,LMS,4H<   ,55HA VALUE FOR NEW SHIP SPEED IS NEEDEMWC01370
     1D.  RETURN TO INPUT<)                                             MWC01380
      CALL MESOUT(MESS)                                                 MWC01390
      CALL STRPAK(MESS,LMS,4H<   ,14HAND ENTER IT.<)                    MWC01400
      CALL MESOUT(MESS)                                                 MWC01410
C                                                                       MWC01420
C RETURN TO CALLING PROGRAM                                             MWC01430
C                                                                       MWC01440
99999 CONTINUE                                                          MWC01450
      RETURN                                                            MWC01460
      END                                                               MWC01470
```

```
C-------------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM-------------MW000010
      SUBROUTINE OUTPUT(CALALL,IOFLAG)                                  MW000020
C------------------SUBPROGRAM DESCRIPTION---------------------------    MW000030
C     SUBROUTINE OUTPUT PROVIDES THE USER WITH A MENU FROM WHICH TO     MW000040
C CHOOSE WHICH MODULE SEGMENT IT IS DESIRED TO OPERATE NEXT.  THE       MW000050
C CHOICES ARE:                                                          MW000060
C          ALL MODULE OUTPUT VARIABLES                                  MW000070
C          THE MODULE UNITS TO BE USED DURING INPUT AND OUTPUT          MW000080
C          THE ESTIMATED MACHINERY WEIGHTS                              MW000090
C          THE COEFFICIENTS FROM LINEFITTING                            MW000100
C     THE UNITS MODULE ALLOWS THE USER TO SPECIFY THE LENGTH, FORCE     MW000110
C AND TIME UNITS TO BE USED DURING INPUT AND OUTPUT.  THE LENGTH UNITS  MW000120
C ARE USED FOR LBP, PROPELLER DIAMETER, DRAFT AND POSSIBLY SPEED.  THE  MW000130
C FORCE UNITS ARE USED FOR WEIGHTS AND THE TIME UNITS MAY BE USED FOR   MW000140
C SPEED.  THE USER HAS THE OPTION OF USING 'KNOTS' FOR SPEED            MW000150
C EVEN IF 'NAUTICAL MILES' AND 'HOUR' ARE NOT THE LENGTH AND TIME       MW000160
C UNITS RESPECTIVELY FOR I/O.                                           MW000170
C    THE ESTIMATED MACHINERY WEIGHTS ARE PROVIDED BY SUBROUTINE MWCHRT  MW000180
C WHICH INCLUDES OTHER SHIP CHARACTERISTICS AS WELL.                    MW000190
C------------------SUBPROGRAM ASSUMPTIONS-------------------------------MW000200
C NONE YET.                                                             MW000210
C------------------OUTPUT VARIABLES-------------------------------------MW000220
C CALALL: .TRUE.  IF THE INPUT VALUE OF CALALL WAS .TRUE. AND NO ERROR  MW000230
C                 OCCURRED WHEN READING OR EDITING AN ESSENTIAL VALUE.  MW000240
C        .FALSE.  IF THE INPUT VALUE OF CALALL WAS .FALSE. OR AN ERROR  MW000250
C                 OCCURRED WHEN READING OR EDITING AN ESSENTIAL VALUE.  MW000260
C------------------INPUT VARIABLES--------------------------------------MW000270
C CALALL: .TRUE.  THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE       MW000280
C        .FALSE.  THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE   MW000290
C IOFLAG: DENOTES THE OPERATION TO BE PERFORMED                         MW000300
C          1 IF THE USER WISHES TO READ THE VARIABLES                   MW000310
C          2                       EDIT                                 MW000320
C          3                       WRITE                                MW000330
C---------------------LABELED COMMON VARIABLES--------------------------MW000340
C LABELED COMMON DIALGF AND MDNCPW HAVE BEEN DEFINED IN SUBROUTINE      MW000350
C MAINPG.                                                               MW000360
C------------------SUBPROGRAMS AND FUNCTIONS CALLED---------------------MW000370
C DEX                                                                   MW000380
C     STRPAK                                                            MW000390
C     LMOVEC                                                            MW000400
C     MENUIN                                                            MW000410
C DEX LIBRARY                                                           MW000420
C     NONE                                                              MW000430
C MODULE                                                                MW000440
C     MWUNIT                                                            MW000450
C     MWCHRT                                                            MW000460
C     MWCOEF                                                            MW000470
C----------------------------------------------------------------------MW000480
C                                                                       MW000490
```

```
C LABELED COMMONS
C
      COMMON /DIALGT/ MTERSE
      COMMON /MDNCPW/ NCPW
C
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DEFINITIONS
C
      INTEGER IOFLAG,NCPW,NUPT
      INTEGER MENUNM(2),NITEMS,ITEMS(10),ITEM
      INTEGER MESS(16),LMS
      INTEGER READ(2),EDIT(2),WRITE(2)
      LOGICAL CALALL,LOCALL
      LOGICAL MTERSE,LOGVAL,LMOVEC
C
C VARIABLE DATA DEFINITIONS
C
      DATA LMS/16/
      DATA MENUNM/4HOUTP,4HUT  /
      DATA NITEMS/5/
      DATA ITEMS/4HALL ,4H    ,
     1           4HUNIT,4HS   ,
     2           4HWT.I,4HTEMS,
     3           4HCOEF,4HFICI,
     4           4HDONE,4H    /
      DATA READ /4HREAD,4H.< /
      DATA EDIT /4HEDIT,4H.< /
      DATA WRITE/4HWRIT,4HE.</
C
C ACTIVATE THE LOCALL ALL OPTION IF THE CALLING PROGRAM REQUIRES IT.
C NOTE THAT IF LOCALL IS SET IN THIS MANNER, MENU 'OUTPUT' IS NOT
C DEFINED BY THE INVOCATION OF THIS SUBROUTINE.
C
      LOCALL=CALALL
      IF (LOCALL) GO TO 200
C
C PREPARE A PROMPTING MESSAGE FOR MENU 'OUTPUT' AND THEN PROVIDE THE
C MENU TO THE USER.
C
    5 CONTINUE
      IF (MTERSE) GO TO 40
      CALL STRPAK(MESS,LMS,4H<  ,41HSELECT WHICH OUTPUT VARIABLE SEGMEN
     1T TO ◁
      GO TO (10,20,30),IOFLAG
   10 LOGVAL=LMOVEC(READ,1,6,NCPW,MESS,41,NCPW)
      GO TO 50
   20 LOGVAL=LMOVEC(EDIT,1,6,NCPW,MESS,41,NCPW)
      GO TO 50
   30 LOGVAL=LMOVEC(WRITE,1,7,NCPW,MESS,41,NCPW)
      GO TO 50
```

```
   40 CONTINUE
      CALL STRPAK(MESS,LMS,4H<   ,22HWHICH OUTPUT SEGMENT?<)
   50 CONTINUE
      ITEM=MENUIN(MENUNM,NITEMS,ITEMS,MESS)
      GO TO (100,200,300,400,500),ITEM
C
C SET THE OUTPUT ALL OPTION.
C
  100 CONTINUE
      LOCALL=.TRUE.
C
C READ, EDIT OR WRITE THE INPUT/OUTPUT MODULE UNITS.
C
  200 CONTINUE
      CALL MWUNIT(LOCALL,IOFLAG)
      IF (LOCALL) GO TO 300
      IF (.NOT.CALALL) GO TO 5
      CALALL=.FALSE.
      GO TO 500
C
C CALL MWCHRT TO READ, EDIT OR WRITE THE ESTIMATED WEIGHT ITEM.
C
  300 CONTINUE
      NUPT=0
      CALL MWCHRT(LOCALL,IOFLAG,NUPT)
      IF (LOCALL) GO TO 400
      IF (.NOT.CALALL) GO TO 5
      CALALL=.FALSE.
      GO TO 500
C
C CALL MWCOEF TO READ, EDIT OR WRITE THE LINE EQUATION COEFFICIENTS.
C
  400 CONTINUE
      CALL MWCOEF(LOCALL,IOFLAG)
      IF (LOCALL) GO TO 500
      IF (.NOT.CALALL) GO TO 5
      CALALL=.FALSE.
C
C RETURN TO CALLING PROGRAM.
C
  500 CONTINUE
      RETURN
      END
```

```
C-----------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM---------------
      SUBROUTINE MWCOFF(ALLFLG,IOFLAG)
C-------------------SUBPROGRAM DESCRIPTION---------------------------
C     SUBROUTINE MWCOFF ALLOWS THE USER TO READ, EDIT OR WRITE THE
C COEFFICIENTS OF THE EQUATION OF A STRAIGHT LINE.
C-------------------SUBPROGRAM ASSUMPTIONS-----------------------------
C NONE YET
C------------------OUTPUT VARIABLES------------------------------------
C ALLFLG: .TRUE.  IF THE INPUT VALUE OF ALLFLG WAS .TRUE. AND NO ERROR
C                 OCCURRED WHEN READING OR EDITING A COEFFICIENT
C         .FALSE. IF THE INPUT VALUE OF ALLFLG WAS .FALSE. OR AN ERROR
C                 OCCURRED WHEN READING OR EDITING A COEFFIIENT
C---------------------INPUT VARIABLES----------------------------------
C ALLFLG: .TRUE.  IF THE ALL OPTION OF THE CALLING PROGRAM IS ACTIVE
C         .FALSE.  IF THE ALL OPTION OF THE CALLING PROGRAM IS NOT ACTIVE
C IOFLAG: DENOTES THE OPERATION TO BE PERORMED
C         =1 IF THE USER WISHES TO READ A COEFFICIENT
C          2                      EDIT
C          3                      WRITE
C---------------------LABELED COMMON VARIABLES-------------------------
C LABELED COMMON DIALGF,MDNCPW,INOUTF, AND REFNOS HAVE BEEN DEFINED IN
C SUBROUTINE MAINPG.
C..........COEFFS INITIALIZED IN BLOCK DATA
C C     : A TWO-ELEMENT ARRAY WHICH CONTAINS THE SLOPE AND Y-INTERCEPT
C         RESPECTIVELY OF AN EQUATION OF A STRAIGHT LINE
C..........COINFO INITIALIZED IN BLOCK DATA
C CFNAME: THE DATABASE NAME OF THE ARRAY CONTAINING THE COEFFICIENTS
C         OF THE EQUATION OF A STRAIGHT LINE
C CFCMNT: THE DATABASE COMMENT OF THE COEFFICIENT ARRAY
C COFORM: THE FORMAT TO BE USED WHEN READING THE ARRAY FROM OR WRITING
C         IT TO A SEQUENTIAL FILE
C DEFC  : AN ARRAY WHICH CONTAINS THE DEFAULT VALUES OF THE COEFFICIENTS
C NDEFC : THE NUMBER OF DEFAULT VALUES
C-------------------SUBPROGRAMS AND FUNCTIONS CALLED--------------------
C DEX
C     NONE
C DEX LIBRARY
C     RAILDR
C     RAREDT
C     RARDMP
C MODULL
C     NONE
C---------------------------------------------------------------------
C
C LABELED COMMONS
C
      COMMON /DIALGF/ MIERSE
      COMMON /MDNCPW/ NCPW
      COMMON /INOUTF/ IMODE,OMODE
```

```
      COMMON /REFNOS/ RNRFIL,RNWFIL
      COMMON /COEFFS/ C(2)
      COMMON /COINFO/ CFNAME,CFCMNT,COFORM,DEFC(2),NDEFC
C
C VARIABLE AND FUNCTION TYPE DEFINITIONS AND DIMENSIONS
C
      INTEGER IOFLAG,IMODE,OMODE,NCPW,RNRFIL,RNWFIL
      INTEGER CFNAME(2),CFCMNT(16),COFORM(2),PMES(16),UNITNM(3)
      INTEGER EFROM,NTO,MXTOGT,CGOT,CFROM
      LOGICAL ALLFLG,MIERSE,LOGVAL
      LOGICAL RAILDR,RAREDT,RARDMP
      REAL C,UNITFM,UNITFA,DEFC
C
C VARIABLE DATA DEFINITIONS
C
      DATA UNITNM/4HNONE,4H    ,4H    /
      DATA CFROM,NTO,MXTOGT,CGOT /1,2,2,2/
      DATA UNITFM,UNITFA /1.0,0.0/
C
C BRANCH ACCORDING TO THE OPERATION TO BE PERFORMED
C
      GO TO (100,200,300),IOFLAG
C
C READ THE COEFFICENTS.
C
  100 CONTINUE
      LOGVAL=RAILDR(C,ALLFLG,CGOT,
     1                  MIERSE,IMODE,NCPW,
     2                  CFNAME,MXTOGT,UNITFM,UNITFA,UNITNM,.TRUE.,
     3                  .TRUE.,PMES,CFCMNT,
     4                  RNRFIL,COFORM,
     5                  NDEFC,DEFC)
      GO TO 99999
C
C EDIT COEFFICIENTS.
C
  200 CONTINUE
      LOGVAL=RAREDT(C,ALLFLG,
     1                  CFNAME,EFROM,NTO,
     2                  UNITFM,UNITFA,UNITNM,.TRUE.,
     3                  .TRUE.,PMES,CFCMNT,
     4                  RNRFIL,COFORM,
     5                  NDEFC,DEFC)
      GO TO 99999
C
C WRITE COEFFICIENTS.
C
  300 CONTINUE
      LOGVAL=RARDMP(ALLFLG,
```

```
     1                    MTERSE,OMODE,NCPW,                                    MWC00990
     2                    C,CFNAME,CFROM,CGOT,                                  MWC01000
     3                    UNITFM,UNITTA,UNITNM,                                 MWC01010
     4                    .TRUE.,PMES,CFCMNT,                                   MWC01020
     5                    RNWFIL,COFORM)                                        MWC01030
C                                                                               MWC01040
C RETURN TO CALLING PROGRAM.                                                    MWC01050
C                                                                               MWC01060
99999 CONTINUE                                                                  MWC01070
      RETURN                                                                    MWC01080
      END                                                                       MWC01090
```

```
C-------------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM-------------
      BLOCK DATA
C----------------SUBPROGRAM DESCRIPTION------------------------------
C THIS SUBPROGRAM INITIALIZES VARIABLES IN THE LABELED COMMON BLOCKS OF
C THIS MODULE.
C EACH LABELED COMMON AND ALL RELATED STATEMENTS AND DEFINITIONS ARE
C LISTED UNDER THE SUBPROGRAM NAME WHERE THE COMMON FIRST APPEARS.
C-----------------------------------------------------------------------
C................SUBROUTINE MAINPG......................................
      COMMON /DIALGF/ MTERSE
      COMMON /MDNCPW/ NCPW
      COMMON /INOUTF/ IMODE,OMODE
      COMMON /REFNOS/ RNRFIL,RNWFIL
      INTEGER NCPW,IMODE,OMODE,RNRFIL,RNWFIL
      LOGICAL MTERSE
      DATA NCPW/4/
      DATA MTERSE/.FALSE./
      DATA IMODE/2/
      DATA OMODE/2/
      DATA RNRFIL/3/
      DATA RNWFIL/4/
C....................SUBROUTINE LUNIT...................................
      COMMON /LUNITS/ PSTLUN,UIOLUN
      COMMON /LUINFO/ DBLUNN,DBLUNC,LUNFRM,DEFLUN
      INTEGER PSTLUN,UIOLUN
      INTEGER DBLUNN(2),DBLUNC(16),LUNFRM(2),DEFLUN
      DATA PSTLUN/2/
      DATA UIOLUN/2/
      DATA DBLUNN/4HUIOL,4HUN  /
      DATA DBLUNC/4HLENG,4HTH U,4HNIT ,4HTO B,
     1            4HE US,4HED D,4HURIN,4HG IN,
     2            4HPUT ,4HOUTP,4HUT< ,4H    ,
     3            4H    ,4H    ,4H    ,4H    /
      DATA LUNFRM/4H(I10,4H)   /
      DATA DEFLUN/2/
C....................SUBROUTINE TUNIT..............................
      COMMON /TUNITS/ PSTTUN,UIOTUN
      COMMON /TUINFO/ DBTUNN,DBTUNC,TUNFRM,DEFTUN
      INTEGER PSTTUN,UIOTUN
      INTEGER DBTUNN(2),DBTUNC(16),TUNFRM(2),DEFTUN
      DATA PSTTUN/1/
      DATA UIOTUN/1/
      DATA DBTUNN/4HUIOT,4HUN  /
      DATA DBTUNC/4HTIME,4H   U,4HNIT ,4HTO B,
     1            4HE US,4HED D,4HURIN,4HG IN,
     2            4HPUT ,4HOUTP,4HUT< ,4H    ,
     3            4H    ,4H    ,4H    ,4H    /
      DATA TUNFRM/4H(I10,4H)   /
      DATA DEFTUN/1/
```

```
C....................SUBROUTINE FUNIT..................................
      COMMON /FUNITS/ PSTFUN,UTOFUN
      COMMON /FUINFO/ DBFUNN,DBFUNC,FUNFRM,DEFFUN
      INTEGER PSTFUN,UTOFUN
      INTEGER DBFUNN(2),DBFUNC(16),FUNFRM(2),DEFFUN
      DATA PSTFUN/4/
      DATA UTOFUN/4/
      DATA DBFUNN/4HUTOF,4HUN  /
      DATA DBFUNC/4HFORC,4HE  U,4HNIT ,4HTO B,
     1            4HE US,4HED D,4HURIN,4HG IN,
     2            4HPUT ,4HOUTP,4HUT<,4H    ,
     3            4H    ,4H    ,4H    ,4H    /
      DATA FUNFRM/4H(I10,4H)    /
      DATA DEFFUN/4/
C....................SUBROUTINE MWCHRT.................................
      COMMON /VARFRM/ INTFRM,RSCFRM
      COMMON /INFO2/  LBPNAM,CMNT2,DEF2
      COMMON /INFO5/  HNAME,CMNT5,DEF5
      COMMON /INFO19/ PPTNAM,CMNT19,DEF19
      COMMON /INFO20/ SHPNAM,CMNT20,DEF20
      COMMON /INFO21/ NSHENM,CMNT21,DEF21
      COMMON /INFO24/ VSUSNM,CMNT24,DEF24
      COMMON /INFO27/ PRPNAM,CMNT27,DEF27
      COMMON /INFO28/ DPRPNM,CMNT28,DEF28
      COMMON /INF200/ W200NM,CMT200,DEF200
      COMMON /INF201/ W201NM,CMT201,DEF201
      COMMON /INF203/ W203NM,CMT203,DEF203
      COMMON /NEWINF/ LBPNEW,HNEW,PPTNEW,SHPNEW,NSHNEW,VSUSNU,PRTNEW,
     1                DPRNEW,W200NU,W201NU,W203NU
      INTEGER INTFRM(2),RSCFRM(2)
      INTEGER LBPNAM(2),HNAME(2),PPTNAM(2),SHPNAM(2),NSHENM(2),
     1        VSUSNM(2),PRPNAM(2),DPRPNM(2),W200NM(2),W201NM(2),
     2        W203NM(2)
      INTEGER CMNT2(16),CMNT5(16),CMNT19(16),CMNT20(16),CMNT21(16),
     1        CMNT24(16),CMNT27(16),CMNT28(16),CMT200(16),
     2        CMT201(16),CMT203(16)
      INTEGER PPTNEW,NSHNEW,PRTNEW
      INTEGER DEF19,DEF21,DEF27
      REAL DEF2,DEF5,DEF20,DEF24,DEF28,DEF200,DEF201,DEF203
      REAL LBPNEW,HNEW,SHPNEW,VSUSNU,DPRNEW,W200NU,W201NU,W203NU
      DATA INTFRM/4H(I10,4H)    /
      DATA RSCFRM/4H(F9.,4H2)   /
      DATA LBPNAM/4HLBP ,4H     /
      DATA HNAME /4HT    ,4H    /
      DATA PPTNAM/4HPPTY,4HPE   /
      DATA SHPNAM/4HSHP ,4H     /
      DATA NSHENM/4HNSHA,4HFT   /
      DATA VSUSNM/4HVSUS,4H     /
      DATA PRPNAM/4HPRPT,4HYP   /
```

```
      DATA DPRPNM/4HDPRO,4HP   /
      DATA W200NM/4HW200,4H    /
      DATA W201NM/4HW201,4H    /
      DATA W203NM/4HW203,4H    /
      DATA CMNT2 /4HLENG,4HTH B,4HETWE,4HEN P,4HERPE,4HNDIC,4HULAR,
     1            4HS (?,4H????,4H????,4H???),4H<   ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMN15 /4HMOLD,4HED D,4HRAFT,4H TO ,4HKEEL,4H (??,4H????,
     1            4H????,4H??)<,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMNT19/4HTYPE,4H OF ,4HPROP,4HULSI,4HON P,4HLANT,4H(REE,
     1            4HD)< ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMNT20/4HTOTA,4HL IN,4HSTAL,4HLED ,4HSHAF,4HT HO,4HRSEP,
     1            4HOWER,4H (??,4H????,4H????,4H??)<,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMNT21/4HNUMB,4HER O,4HF PR,4HOPEL,4HLER ,4HSHAF,4HTS<,
     1            4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMNT24/4HMAXI,4HMUM ,4HCONT,4HINUO,4HUS S,4HUSTA,4HINED,
     1            4H SPE,4HED (,4H????,4H????,4H????,4H)< ,4H    ,
     2            4H    ,4H    /
      DATA CMNT27/4HTYPE,4H OF ,4HPROP,4HELLE,4HR (R,4HEED),4H<  ,
     1            4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMNT28/4HPROP,4HELLE,4HR DI,4HAMET,4HER (,4H????,4H????,
     1            4H????,4H)< ,4H    ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMT200/4HWT O,4HF BO,4HILER,4HS AN,4HD EN,4HERGY,4H CON,
     1            4HVERT,4HERS ,4H(???,4H????,4H????,4H?)< ,4H    ,
     2            4H    ,4H    /
      DATA CMT201/4HWT O,4HF PR,4HOPUL,4HSION,4H UNI,4HTS (,4H????,
     1            4H????,4H????,4H)< ,4H    ,4H    ,4H    ,4H    ,
     2            4H    ,4H    /
      DATA CMT203/4HWT O,4HF PR,4HOPEL,4HLERS,4H, SH,4HAFTI,4HNG A,
     1            4HND B,4HEARI,4HNGS ,4H(???,4H????,4H????,4H?)<,
     2            4H    ,4H    /
      DATA DEF2,DEF5,DEF20,DEF24,DEF28 /0.0,0.0,0.0,0.0,0.0/
      DATA DEF19,DEF21,DEF27 /0,0,0/
      DATA DEF200,DEF201,DEF203 /0.0,0.0,0.0/
      DATA LBPNEW,HNEW,PPTNEW,SHPNEW,NSHNEW,VSUSNU,PRTNEW,DPRNEW,
     1     W200NU,W201NU,W203NU
     2     /420.,15.1,2,70000.,2,33.,1,12.,229.3,128.2,127.6/
C..................SUBROUTINE INPUT....................................
      COMMON /WTFLAG/ WFLAG
      COMMON /CRVPTS/ NPTS,IND(10),DEP(10)
      INTEGER WFLAG,NPTS
      REAL IND,DEP
      DATA WFLAG /1/
```

```
      DATA NPTS/0/                                                      BL001480
      DATA IND(1),IND(2),IND(3),IND(4),IND(5),IND(6),IND(7),            BL001490
     1     IND(8),IND(9),IND(10)                                        BL001500
     2     /0.,0.,0.,0.,0.,0.,0.,0.,0.,0./                              BL001510
      DATA DEP(1),DEP(2),DEP(3),DEP(4),DEP(5),DEP(6),DEP(7),            BL001520
     1     DEP(8),DEP(9),DEP(10)                                        BL001530
     2     /0.,0.,0.,0.,0.,0.,0.,0.,0.,0./                              BL001540
C................SUBROUTINE MWCOEF...................................... BL001550
      COMMON /COEFFS/ C(2)                                              BL001560
      COMMON /COINFO/ CFNAME,CFCMNT,COFORM,DEFC(2),NDEFC                BL001570
      INTEGER CFNAME(2),CFCMNT(16),COFORM(2),NDEFC                      BL001580
      REAL C,DEFC                                                       BL001590
      DATA C /0.,0./                                                    BL001600
      DATA CFNAME/4HSL C,4HOEFF/                                        BL001610
      DATA CFCMNT/4HCOEF,4HFICI,4HENTS,4H OF ,4HTHE ,4HEQUA,4HTION,     BL001620
     1            4H OF ,4HA ST,4HRAIG,4HHT L,4HINE ,4H(SLO,4HPE,Y,     BL001630
     2            4H-INT,4HCPX/                                        BL001640
      DATA COFORM/4H2(E1,4H3.6)/                                        BL001650
      DATA NDEFC,DEFC(1),DEFC(2) /2,0.00234,48.09/                      BL001660
      END                                                               BL001670
```

```
C-------------MACHINERY WEIGHT ESTIMATING MODULE SUBPROGRAM-------------
      SUBROUTINE LINFIT(N,X,Y,C)
C------------------SUBPROGRAM DESCRIPTION---------------------------
C     SUBROUTINE LINFIT CALCULATES THE COEFFICIENTS FOR A STRAIGHT
C LINE FIT OF DATA POINTS.  THE COEFFICIENTS A AND B AND X AND Y ARE
C DEFINED AS:
C          Y=AX+B
C     THE VALUES OF A AND B ARE RETURNED TO THE CALLING PROGRAM AS THE
C FIRST AND SECOND ELEMENTS RESPECTIVELY OF ARRAY C.
C------------------SUBPROGRAM ASSUMPTIONS-----------------------------
C NONE YET
C------------------OUTPUT VARIABLES-----------------------------------
C C     : AN ARRAY CONTAINING THE VALUES OF THE SLOPE (A) AND THE
C         Y-INTERCEPT (B) OF THE LINE
C------------------INPUT VARIABLES------------------------------------
C N     : THE NUMBER OF PAIRS OF DATA POINTS
C X     : AN ARRAY CONTAINING THE ABSCISSAS OF THE DATA POINTS
C Y     : AN ARRAY CONTAINING THE ORDINATES OF THE DATA POINTS
C---------------------------------------------------------------------
C
C VARIABLE DEFINITIONS AND DIMENSIONS
C
      INTEGER N
      REAL X(N),Y(N),C(2)
      REAL A,B,SUMXI,SUMXI2,SUMYI,SUMYI2,SMXIYI
      REAL R2,SGMAXY,SIGMAX,SIGMAY
C
C INITIALIZE VARIABLES.
C
      SUMXI=0.
      SUMXI2=0.
      SUMYI=0.
      SUMYI2=0.
      SMXIYI=0.
C
C CALCULATE THE COEFICIENTS A AND B.
C
      DO 10 I=1,N
      SUMXI=SUMXI+X(I)
      SUMXI2=SUMXI2 + X(I)*X(I)
      SUMYI=SUMYI + Y(I)
      SUMYI2=SUMYI2 + Y(I)*Y(I)
      SMXIYI=SMXIYI + X(I)*Y(I)
   10 CONTINUE
      B=((SUMXI2*SUMYI)/SUMXI - SMXIYI)/((N*SUMXI2/SUMXI) - SUMXI)
      C(2)=B
      A=(SUMYI-N*B)/SUMXI
      C(1)=A
C
```

```
C CALCULATE AND PRINT THE GOODNESS OF FIT.
C
      SGMAXY=SMXIYI-((SUMXI*SUMYI)/N)
      SIGMAX=SUMXI2-((SUMXI**2)/N)
      SIGMAY=SUMYI2-((SUMYI**2)/N)
      R2=(SGMAXY**2)/(SIGMAX*SIGMAY)
      WRITE(18,99) R2
   99 FORMAT(3X,'A STRAIGHT LINE WAS FIT TO THE DATA WITH A GOODNESS OF
     1 FIT OF',1X,F6.4)
C
C RETURN TO CALLING PROGRAM
C
      RETURN
      END
```

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